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AND

MECHANICS' MAGAZINE.

VOL. VII.—NEW SERIES.—No. 6. VOL. I.

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Will please take notice that this Journal can only be sent to those who pay for it. The delay of payment by many who had received it for years, caused the suspension of its publication for six months, during the past year. Its publication has, however, been again resumed, and the *first six numbers* including the present, have been sent to all who were subscribers at the period of its suspension, and will be continued regularly to all who *have paid for the current year*; but after this period, it will *not be sent to those whose accounts are unpaid*; as a want of means will compel us to publish *only* a number sufficient to supply those who pay. This measure is adopted from *necessity*, not from choice, and we hope therefore that each subscriber will remit the amount due, without delay, as we shall not be able to supply them with the numbers *after* we diminish the number published.

The annexed bill shows the condition of the account, where there is a balance due, according to our books; and you are respectfully requested to remit the amount by mail, without delay, *at our risk*.

Mr. _____

To the Office of the RAILROAD JOURNAL & MECHANICS' MAGAZINE, Dr.

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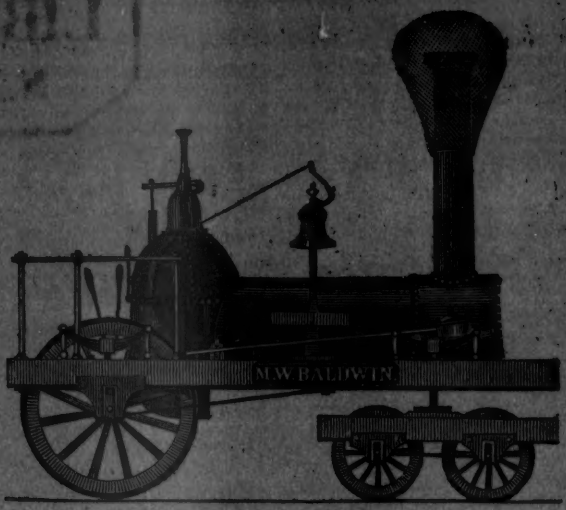

M. W. BALDWIN, *Manufacturer of Locomotive Steam Engines, Stationery Engines, Steamboat Engines, Railroad Machinery, Sugar Mills, &c. &c., Broad Street, Philadelphia.*

References to the following Companies, where the annexed Nos. of his Engines are in use:

	Nos. of Engines.	
Columbia and Philadelphia State Road,		24
Harrisburgh and Lancaster	Pa.	6
Little Schuylkill,	"	2
Cumberland Valley,	"	1
Philadelphia and Reading,	"	1
Phila., Germantown, and Norristown,	"	4
Boston and Providence,	Mass.	3
Boston and Worcester,	"	2
Utica and Schenectady,	N. Y.	12
Rensellaer and Saratoga,	"	2
Long Island,	"	2
Rochester and Tonawanda,	"	2
Clinton and Port Hudson,	Lou.	2
Island of Cuba,		2
Madison and Indianapolis,	Ind.	1
N. Cross Road,	Illinois	1
		67

	Nos. of Engines.	
Philadelphia and Trenton,	N. J.	4
New-Jersey Transportation Co.	"	5
Morris and Essex,	"	1
Philadelphia, Wilmington and Baltimore,		4
Charleston and Hamburg,	S. C.	4
Central Road, Savannah,	Geo.	2
Augusta Railroad,	"	6
Monroe Railroad,	"	1
Commercial Railroad, Vicksburg,	Miss.	2
West Feliciana,	"	1
Mobile and Cedar Point,	Ala.	1
Tuscumbia and Decatur,	"	1
Detroit and Ypsilanti,	Mich.	2
Adrian and Toledo,	"	2
Lake Wimico and St. Joseph's	Florida.	2
		39

From the annexed testimonials, it will be seen that the Engines of M. W. B., are not inferior in capacity of performance to any Engines in this, or any other country; while at the same time they combine several improvements secured by patent, and many advantages not to be found in other Engines.

One very important advantage is, the simplicity of their construction and arrangement, by which every part of the machinery is perfectly accessible while the engine stands upon the road.

The improvement in the construction of the cranks is one of *great importance*, obviating the liability to break,—an occurrence so common to most locomotive engines.

Another great advantage arises from having the fire-box before the driving wheels, thus making an equal distribution of weight, which wholly corrects the galloping or undulating motion peculiar to both 4 and 6 wheel engines, with the fire-box behind the driving shaft, making them more easy upon the road than any engines of the same capacity now in use; while, by the very simple device of throwing a portion of the weight of the tender upon the driving wheels, or detaching it at pleasure, the engine is made to possess the advantage of a light with the adhesion of a heavy engine upon the ascents where increased adhesion is required.

In order to test their comparative merits, when used on the same roads with other engines, he suggests that a regular account be kept, of expenses of repairs, distance travelled and work performed by each engine; which will furnish the only correct data by which to judge of their respective merits, which cannot be correctly done by a few experiments made for the purpose of effect.

M. W. B. manufactures three classes of Engines, Nos. 1, 2, and 3. Most of the above engines belong to the 3d, or smaller class, and many of them have been in use from two to four years. His present engines are very much improved. One of the first class, recently built, has drawn over the Columbia road, part of which has an ascending grade of 45 feet per mile, 35 loaded cars weighing 187 tons, equal to about 700 tons on a level.

Orders for engines or machinery promptly executed, on application to M. W. BALDWIN, Philadelphia, or to E. L. MILLER, his agent, for contracts in the city of New York.

The following testimonials of the merits of these engines, have been received from Officers, Engineers, and Superintendents of motive power, &c. &c. of several of the roads above referred to.

Mr. JOHN BRANDT, Superintendent of Engines and Machinery, on the Columbia and Philadelphia Railroad, writes under date of the 11th of May, 1338:—"We have twenty-four of your engines, several of which have been in use since the fall of 1834. Two of your 3d class engines commenced running Feb. 22d, 1837, and travelled 55,6.5 miles, up to the 1st of May, 1838, and cost for repairs during the above-mentioned time, one cent and eight mills per mile. Eight engines of the first class, have travelled from the 1st of January, 1838, to the 1st of May, (4 months) 46,569 miles, made 653 trips, drawing 16,836 cars; the cost per mile for these four months, I am now unable to show, as our books are not posted, but can assure you that the expenses this year will be less per mile than any former years. One of the first class recently built, has drawn over the Columbia road, part of which has an ascending grade of 45 feet per mile, 35 loaded cars, weighing 187 tons, equal to about 700 tons on a level, and travelled from 8 to 12 miles per hour, except on the wooden track. This is the heaviest train that has ever passed over the road."

JAMES T. SHIPMAN, Resident Engineer of the Long Island Railroad Company, writes May 21st, 1838: "We have two engines of class No. 3, of your manufacture, which have been in use since May, 1836. Their performance is worthy of the most unqualified praise. We carry as an ordinary load, 15 freight cars, weighing 5¼ tons each; and to show their efficiency, we have frequently taken 20 cars without difficulty, up an ascent of 35 feet to the mile; and have carried 4 cars up a grade of 211 feet per mile for a distance of 2,100 feet. The average speed for freight is 10 miles, and for passengers, from 20 to 25 miles per hour. In the summer of 1837, they performed the distance of 162 miles each day, and from the journal which now lies before me, it appears that under this severe usage, there was no failure in either of these engines for 6 months, which rendered a change in their usual time of running necessary, or caused any delay, either in the transportation of passengers or freight. I am fully satisfied that the cost of repairs does not exceed one half that of a four wheel engine doing the same work."

Mr. JOHN CASH, superintendent of motive power, on the Norristown Railroad, says under date of May, 1838: "I take great pleasure in bearing testimony to the excellence of your engines. They are well adapted to light or heavy loads. With one of the small class which has been nearly three years in constant service, I have drawn a train of 750 passengers, over grades of 32 feet per mile, at the rate of 14 miles per hour."

Mr. J. ELLIOT, Superintendent of Motive power, on the Philadelphia, Wilmington, and Baltimore Railroad, writes: "After an experience of several years with Locomotive engines on different roads, I am of opinion that the engines of M. W. Baldwin, are easier upon the road than any engines in use, and that they combine more advantages than any locomotives within my knowledge. They have been almost constantly running for the last eighteen months. The engine Brandywine, has been running 265 days, at a cost for repairs of $65 17, and has lost but 5 days since she was put on the road. The Christiana has been running 135 days at a cost of but $20 for repairs. Their average speed is 24 miles per hour, including stoppages."

L. G. CANNON, President, and L. R. SARGENT, superintendent of the Rensselaer and Saratoga Railroad Company, say under date of 29th of May, 1838: "We have two of your locomotives which have been in use about three years. They *work well* in every particular; and I deem it but an act of justice to say that the manufacture and materials of each have proved to be of the highest order, and I have evidence from the official reports of other companies, and my own experience here, that your engines will, in *performance* and *cost of repairs*, bear comparison with any engines made in this, or any other country."

W. W. WOOLSEY, Esq. President of the Boston and Providence Railroad Company, writes on the 31st of May, 1838: "We have three of your Engines, which have been in use since about June, 1836. We have never had occasion to put them to their maximum capacity. They have carried 17 freight cars of gross weight, say 85 tons, engine and tender not included, over the road at an average speed of 10 miles per hour, including an ascent of 5 miles in length, one half mile of which is 42½ feet per mile, and the remaining four and a half miles, 37½ feet per mile. They carry ten passenger, and three baggage cars, very easily over the road, at an average speed of 18 or 20 miles per hour. Your engines give *entire satisfaction*."

AMERICAN

RAILROAD JOURNAL,

AND

MECHANICS' MAGAZINE.

No. 6, Vol. I. New Series.] SEPTEMBER 15, 1838. [Whole No. 318. Vol. VII.

Remarks on De Pambour's Formula of Locomotive Engines.

To the Editors of the Railroad Journal.

GENTLEMEN,—In your Journal of the 1st, I observe a communication from C. E. Detmold, Esq., establishing (to his satisfaction) the general correctness of De Pambour's formula of Locomotive Engines.

In doing this, Mr. Detmold first charges the undersigned with having "obtained a monstrous result," through the wrong application of the formula in a certain case; and then applies (rightly of course) to the same case, the formula for determining the maximum load—and the velocity with which the engine will move that load. The result is, that this Engine, (the VESTA, according to his calculation) will draw 191·7 tons, at a velocity of 13·5 miles per hour.

In making these computations, Mr. Detmold has taken the effective pressure per square inch in the boiler at 58 lbs. De Pambour says it was 56·5lbs. at the time of this experiment. He has also "taken the ratio of the volume of steam at the total pressure at the time of the experiment, to the volume of water that produced it, at 414"—the table given by De Pambour makes the ratio 393, when the effective pressure is 58lbs. and 400 when it is 66·5lbs. per square inch in the boiler. Mr. Detmold also says, "and diameter of cylinder ·9375 feet"—now De Pambour says the VESTA's cylinders are 11¼ inches diameter, equal to ·92708+ feet. We would gladly have spared Mr. Detmold's feelings, by passing these inaccuracies in silence, did they not affect the statements given below.

If we now take the true results of the formula, as *applied* by Mr Detmold, we have for the maximum load of this engine 186 4 tons, at a velocity of ·68776+feet, equal to 13·03 miles per hour; while the experiment shows that the engine drew 189 tons at 3 miles per hour; in other words, the formula gives, in this instance, a velocity about 4⅓ times as great as the engine did attain with *the given* load. Is it possible that Mr. Detmold thinks that this "result corresponds very nearly to that of the actual experiment?" Does he consider this as "close a corroboration as the most fastidious could require?" If so, we must continue to differ on this point with him, and the "*many others*," even though we do it at the risk of being thought somewhat "*fastidious*."

Again, Mr. Detmold says "the velocity of the engine may be reduced

below this point," (meaning the velocity which the formula gives for a maximum load) "but certainly *the load cannot be increased beyond its maximum.*

We give below, the results of all the experiments made by De Pambour with this engine, when the load was so great that it could not reach a speed of 13·03 miles per hour, even though the water in the tender was, in two instances, lukewarm. They are as follows:

120 tons	12·10	miles per hour	55lbs.	effec. pres.	per sq. inch	in	boiler.
183 "	3 25	"	"	58 "	"	"	"
189 "	3 00	"	"	56·5	"	"	"

Now 186·4 tons is the maximum load, according to the formula, for all velocities up to 13·03 miles per hour, when the effective pressure in the boiler is 56·5lbs. per square inch, and 12·10 miles per hour is below the velocity which the formula gives for the maximum load with the effective pressure of 55lbs. per square inch.

Query.—If this engine can draw 186·4 tons at 13 03 miles per hour, (as per results of formula) how does it happen, that at 12 10 miles per hour, under very favorable circumstances, it can only draw 129 tons?" Or 184 tons, at 3·26 miles per hour? Or, that it can move 189 tons at all?

Query 2d.—If, (according to the formula) this engine can draw the same load at 13 03 miles per hour, that it can draw at any less velocity; then how does it happen, that with every reduction of velocity, even to the lowest tried, there is a corresponding increase of load, "*beyond its maximum*" in one instance? Can Mr. Detmold see "*no great difference* here between the result of the formula and that of the experiment?" Or, will he say "these results no longer suit the question?"

If he will take the trouble to compare all De Pambour's experiments where the engine was in good order, the regulator entirely open, and the load less than a maximum by the formula, he will find that the discrepancy between the results of the formula, and the experiments, falls below 10 per cent. of the load drawn, only in about $\frac{1}{4}$ of the whole number; and in about $\frac{1}{5}$ it is between 10 and 20 per cent.; about $\frac{1}{4}$ between 20 and 40 per cent.; $\frac{1}{6}$ between 40 and 100 per cent.; and in the remainder, (about $\frac{1}{8}$,) the discrepancy is over 100 per cent.

And with a little additional trouble, he will find also that De Pambour, in one of his "*practical tables*," has made the same use of the formula that we did in the case of the engine VESTA: that is to say, he "continued the equation beyond the point where P is equal to R."

Again: Mr. Detmold has applied De Pambour's formula to an imaginary case, (Mr. Johnson's supposed engine,) and finds that the engine, with 70 lbs. total pressure per square inch, will draw 336 tons: and then, by changing the equation, draws therefrom the resistance of this load when referred to the pistons, which he finds to be 69·9 lbs per square inch. *Wonderful coincidence!*—and still more wonderful, that Mr. Detmold, (judging from his communication) should have made two solutions of the same simple equation so nearly agree. And this too, he calls "a close corroboration of theory by practice;"—a novel way truly, of comparing theory and practice.

It is not difficult to see how Mr. Detmold arrives at the conclusion that *he* has "sufficiently proved the general correctness of De Pambour's formula!" But it would be strange indeed, if his *reasoning* should lead many others to the same mysterious conclusion.

Perhaps Mr. Detmold may be induced, (for the special benefit of the profession) to "pursue this subject" somewhat "farther." No doubt but Mr. Johnson already feels himself under great obligations for the very valuable suggestions in regard to his "tabular statement." And for aught we know, there may be "many others," whose obligations do not fall a whit below Mr. Johnson's.

Before closing, we wish to say, that we yield to none in admiring the "talent, industry," and skill of De Pambour, who, born to rank and affluence, has unsparingly devoted time and money to the patient investigation of a subject, most deeply interesting to every philanthropist. Perhaps no other man in the wide world, would, in the like circumstances, have accomplished so much. At any rate, among the thousands similarly situated, he alone seems to have been undaunted by the magnitude and difficulty of this subject. Nevertheless, it should not be forgotten, that he does not "pretend to have produced a perfect work." He says, "We thought our work would at last have this result, to call the public attention on the subject. We shall feel happy if we have succeeded in some of our researches; and happy also, if others, in correcting our errors, shall at least elucidate the facts upon which we have called their attention."

Yours truly,

WILLIAM H. TALCOTT.

Cuba, Aug. 28, 1838.

First Annual Report of the President and Engineer-in-Chief of the Central Railroad and Banking Company of Georgia. L. O. REYNOLDS, Chief Engineer.

(Continued from page 151.)

The length of the northern route, I think, may with safety be put down at 200 miles; and it now appears, that if the southern route, is adhered to, we shall be under the necessity of bending down the country, and gaining the valley of the Ocmulgee as low down as Tarversville. Indeed, I have no doubt the interest of the Company would be promoted by such a course. It follows then, that the line would be nearly or quite as long as the northern route. On the accompanying map, I have marked both routes in red lines, as nearly as the data in my possession will enable me to, and you will perceive that the southern measures on the map, are even longer than the northern.

I think I can safely say that no eligible route south of a straight and direct line, can be obtained less than 190 miles long; and I think it very probable that distance would be exceeded.

In regard to the difference in the cost of the two routes, it is impossible with the data in my possession to form an estimate entitled to confidence. I have no doubt, however, that the average cost per mile of the northern route, (provided grades of 30 feet per mile be admitted,) would be less than that of the southern."

The data on which the southern route was recommended, so far as I have any knowledge of it, has been given in a previous part of this report.

"A large portion of the northern, as well as the southern route, particularly on the north side of the Ogechee, was run in long random lines, as time would not then permit us to seek out the best railroad line, and is therefore equally susceptible of improvement."

I feel confident that the distance may be reduced to 200 miles, if not less,

and though we know that grades which shall not exceed 21 $\frac{13}{100}$ feet per mile, are attainable throughout the whole route, without any extraordinary difficulties, yet by increasing the maximum to 30 feet, an immense saving can be made.

You ask me to say whether such a change would be more advantageous to the northern than the southern route.

I think a greater saving of expense would result from such an increase of grade on the northern than the southern route, for the following reasons: On the southern route, the most unfavourable feature in the topography of the country, is the low level in which the streams run, compared with the elevation of the table land between them.

This table land generally falls off very abruptly near the stream, and consequently involves a deep cut and heavy embankment in the crossing. The distance from the high lands on either side to the stream generally not being sufficient to effect a great saving by an increase of grades.

On the northern route, the main difficulties consist in passing two summits; we are obliged to avail ourselves of the valleys of streams running down from these summits, for the purpose of ascent, and to commence the ascent at a greater distance from the summit, in proportion as the rate grade is lessened.

The small streams generally have a rapid fall for a short distance from their h ad, and then have a more gentle descent. The steeper our grade therefore, the sooner we are able to make it coincide with the natural slope of the val ey, while the more gradually we depart from a level, the longer our line is kept away from the stream, and the greater the elevation at wh ch the branches and ravines putting into it have to be crossed.

Such a c ange of grade would of course be advantageous on either route, so far as cost is concerned; and I am of opinion that it would be advisable whichever route is pursued to adopt it.

The maximum grade on the Charleston and Hamburgh road, is 37 feet per mile. Their engines drag trains of 100 tons weight, and perform the distance (136 miles) both ways in three days.

Their passenger trains perform the whole distance of the road in 8 to 10 hours.

You ask 'what points on the northern route should be examined, before a just and proper contrast of the two could be made—and how long it would take to make such examination?'

The main difficulty in making a comparison of the two routes, is a want of information in relation to the southern, for we have as yet designated no entire route by actual survey, with which to compare the northern, either in point of cost or distance. On the northern, we know the utmost extent of the difficulties that we may be obliged to encounter; the only question is, how far those difficulties can be reduced. To ascertain this, I would re-examine the whole country from the mouth of Big Sandy Creek to the Saudersville summit, This should be done thoroughly and carefully, as there are several routes claiming examination, and would require at least two months. I would then make an exploration of the valleys of Commissioners and Walnut Creeks, which would probably prove successful, provided grades of 30 feet per mile were admitted, and effect a saving of 5 or 6 miles in distance, as well as to go into a more populous section of country than to follow the valley of Big Sandy Creek. These surveys with some examinations in the County of Scriven would afford all the information that could be

obtained short of a location of the line, and would occupy about five months.

A full and well appointed party would be required for the performance of this duty, at an expense of about $600 per month.

You ask 'could the proper data be obtained for a determination in time to put under contract 30 to 40 miles on either route by the 1st of November next?

I have no hesitation in saying that it could not, for the *proper data* for a determination would require not only the examination above mentioned on the northern route, but also an experimental survey approximating to a location for the whole distance from the Canouche River to Macon, with estimates of the same. This could not be done before the 1st of September, and as locating is a slow operation requiring much care and exactness, we could not count on having 40 miles ready for contract in less than three months after the decision was made. This would bring us into the month of December, if not January.

There are, then, three alternatives presented to the Board:—1st. To adhere to their former decision, adopting the southern route, and proceed with the locations now going on, as far as the Ohoopee; from thence continue an experimental line to Macon.—2d. To abandon that route at once—take the northern, and locate a portion of it in time for contract by the 1st of November.—3d. To suspend their decision until a full and proper examination of both routes throughout be made, with all the improvements they are susceptible of. This, with the estimates and calculations necessary, would preclude a possibility of getting any portion of the line ready in time for active operations next winter.

Aside from the disadvantages attending the loss of the next working season, the last would doubtless be the most judicious course. What the effect and consequences of such a delay would be, the Board can as well judge as myself.

If the decision is to be made between the first and second alternatives, my opinion would be in favor of the second. The reasons are, the advantages before enumerated of the northern over the southern route, and the additional consideration that we have a favourable country for the distance of 125 miles to Sandersville. If we complete the road thus far, there can be no doubt of our being able to make such a demonstration of its utility, as to enable us to carry it through any difficulties we may find beyond that point, whatever may be the vicissitudes of the times.

On the other hand, we encounter a most expensive section at the very threshold of the southern route. The first six miles beyond the Ogechee River will probably cost $120,000, while this sum will build three times the distance on the northern route.

I have no hesitation in saying, that by yielding to grades of 30 feet per mile, the northern route may at once be adopted at less hazard, than to put under contract, with the knowledge we now have or shall be able to obtain before September, the line from the Ogechee to the Ohoopee. It is certain that our information is more full in relation to the northern than the southern route; for the latter beyond the Ohoopee is still in a great degree left to conjecture."

The Board of Directors passed a resolution, directing 30 miles on each route to be located; this was accomplished, and profiles with careful estimates made of the same. The result shewed a large difference in cost in favor of the northern route; and on the 1st of August, 9 miles of the latter were put under contract—the Board having previously unanimously

resolved to abandon the southern and adopt the northern route. On the first day of October, a further distance of 25 miles was let. On the 6th day of November, 9 miles. On the 3d of January, 9 miles; and on the 5th of the last month 10 miles, making 62 miles, and in all 79 from the depot in Savannah. Of this distance, 67 miles are graded. The superstructure laid 26 miles from the City, to which point our engines now run. Contacts for laying the rails have been extended 51 miles, and for furnishing the timber a further distance of 9 miles.

We have graded 51 miles of the road within this last nine months, and shall be prepared in three months from this time, to extend our contracts for grading 110 miles from this City.

I will close this report with a brief description of the road as far as it is definitely located.

In the southwestern part of the City is our Depot, a tract of 5 acres, which was bestowed on the Company by the City Council of Savannah.

The line leaves this depot, and continues straight N. 77° 10′ W. for 13 miles—then curving slightly to the left on a radius of 150,000 ft., it approaches within a mile and a half of the Ogechee—then bending to the right on a curve of 5,000 feet radius, it follows the general direction of that river; and at a mean distance of about 3 miles from it, through the flat lands of Effingham County, until it reaches the County of Scriven—then taking the hammocks bordering on the River Swamp, to avoid the undulating surface of the pine lands in this county before spoken of, it follows them to Brinson's Mill Creek—then takes the valley of this Creek which leads out from the river, having passed around Paramour Hill, and across Buck Head Creek, the line again resumes the river flats, and continues over them through the County of Burke—crossing the Ogechee at the point before mentioned about 12 miles from Louisville. The locations have been extended about 5 miles up Williamson's Swamp in Jefferson County.

The allignment of the road to a point in Burke County, 83 miles from the depot, consists of 22 straight lines of the aggregate length of 65 miles and 771 feet, and 21 curves of the aggregate length of 16 miles and 4,509 feet—the smallest of the latter on a radius of 2,000 feet. Curves of this sharpness occurring in only three instances, and for short distances.

The aggregate for the deflection is 524° 28′, or a little less than a circle and a half.

The vertical arrangement comprises 16 levels, and 81 slope grades, which may be classed as follows viz:

Level,	13 miles	200	Feet,
Inclination of 5 feet per mile and under	25 "	4300	"
Over 5 feet and under 10 feet	11 "	4220	"
Over 10 feet and under 15 feet	7 "	2240	"
Over 15 feet and under 20 feet	6 "	4320	"
Over 20 feet and under 25 feet	6 "	2120	"
Over 25 feet and under 30 feet,	11 "	3720	"
Total,	83 miles,		

The bottom width of the excavations is 25 feet, with slopes of 150 base to 100 vertical, except in compact clay and sand, when a slope of 45° is given.

The top width of the embankments is 15 feet, with slopes of 150 to 100.

All trees are felled for a width of 165 feet. The culverts and bridges are made of timber, there being no stone for the purpose within reach.

SUPERSTRUCTURE.

The plan of superstructure of this road, differs materially from that most common where the flat plate rail is used.

Cross sleepers are first bedded in the ground and rammed solid; their upper surfaces being level with the grade of the road—string pieces, 6 inches deep, and one foot broad, are then laid flat-wise on the sleepers, and trenailed to them with $1\frac{1}{2}$ inch trenails, their centres being 5 feet asunder, (the width of the track,) and the ground rammed under them, affording a continuous bearing. On the top, and in the centre of these string pieces, is placed a small scantling or lath, 2+3 inches, which is surmounted by the plate rail of iron 3 inches wide by $\frac{3}{4}$ inch thick, weighing $30\frac{1}{2}$ tons to the mile. The iron is confined by spikes 7 inches long, passing through the lath into the string piece. Wrought iron splicing plates $\frac{1}{4}$ inch thick are placed under the joinings of the iron bars, and confined by spikes passing through them. The above arrangement of superstructure was introduced by the former Chief Engineer of the Company, and having had an opportunity of giving it a fair trial I am satisfied of its efficiency.

An embankment containing about 200,000 cubic yards has been made, to pass our road over the marsh forming the valley of Musgrove Creek, in the first mile from the City. The greater portion of the material for this embankment, has been transported from a point about $3\frac{1}{2}$ miles distant, in Cars moved by Locomotive Engines. Upwards of *one hundred thousand tons burthen* has passed over this portion of the road, within the last 12 months, besides the return trips of the empty cars of 12 trains per day.

This is equal to the regular business of three years, and the track, with the exception of some points where it was laid on fresh embankments, is now in good order.

In relation to the cost of the road, I have not the data for making a correct statement of the first 17 miles from the City, as it has been done partly by contract and partly on the Company's account, and the accounts of disbursements were not kept in this office.

The cost of the 51 miles beyond, may be stated as follows:

Grading, including excavation, embankment, clearing, grubbing, bridges and culverts, 51 miles,		$113 484 82
Average for grading.	$2225 19	
Laying track 9 miles,		6 300 00
Furnishing timber 20 miles,		16 002 00
		$135 786 82

The above is exclusive of iron which, including plates and spikes, cost about $2,000 per mile, and also exclusive of cost of engineering.

For the distance of 50 miles from the end of our present contracts, the country is as favourable for the construction of the road as the 51 miles above spoken of, and it may be built at as small cost. The line is free from any objectional curvatures, and the profile presents a surface of most remarkable uniformity, and although some portions of the line hence to Macon will be more expensive—a considerable part of it is equally favourable.

A quantity of iron has been ordered and paid for, sufficient to extend the track 83 miles from the City, some of which has been shipped for this port.

Surveys are now in progress in the vicinity of Macon, for the purpose of ascertaining whether a route is practicable down the valley of Walnut Creek with a maximum grade of 30 feet per mile, and so far as they have progressed the result is favourable.

I am, very respectfully, your obd't serv't,

L. O. REYNOLDS, *Chief-Engineer.*

Description of the Construction of the First Division of the Long Island Railroad, with Remarks. By an ENGINEER.

INTRODUCTION.

THE modes of construction followed on works actually completed, and the cost of the materials actually used, are items of information, with which every engineer desires to be acquainted. Few engineers have the opportunity to collect such information personally, by visiting and examining in detail the different roads in operation, nor would such an examination prove very satisfactory, unless accompanied with that explanation of the circumstances, which only those who superintended or were connected with the work, can give. A short description of every work, prepared after its completion by the engineer, and while all the circumstances were fresh in his recollection, would supply this want, and would probably be always well received by the profession; but the Chief Engineer of a work is rarely able to devote the necessary time to this purpose. In view, however, of the reciprocal benefit which would ensue by the encouragement of such a rule, one or other of the assistants, or the superintendent might undertake the task, and if the result should not be as complete as it would have been, had it emanated directly from the Chief Engineer, there could doubtless always be presented a fund of valuable practical information, sufficiently extensive to render it acceptable to the profession.

Under this belief, the following account of the First Division of the Long Island Railroad has been prepared. The collector, although connected with the engineer department of the first division from the commencement of the work to its completion, has not been able to make the account so complete in respect of cost as is desirable, from the fact that many of the payments were made by officers of the company, whose leisure has not permitted them to furnish him with the details in such a way as to enable him to connect them satisfactorily with the other divisions of expenditure possessed by himself. The graduation of the work referred to, was commenced in May 1836; it was opened for travel in March 1837. The suggestions at the end of the account (and which it will be perceived are directed rather to those interested in this particular road) are submitted with deference.

THE Jamaica Railroad and the Long Island Railroad, although forming so far as is concerned, one continuous track, are distinct properties. The Jamaica Railroad comprehends that part of the road between Brooklyn and Jamaica. The Long Island Railroad comprehends from Jamaica to the eastern extremity of Long Island. The Long Island Railroad Company by their charter, were empowered to construct a road from Brooklyn to Greenport, but as the most feasible ground as far as Jamaica

was already occupied by the Jamaica Railroad, an arrangement was made, whereby the Jamaica Railroad was rented to the other Company for a term of 40 years, at a yearly rent of, I believe, 9 per cent. on its expenditures. The Long Island Railroad, therefore, commences under this arrangement at Jamaica, and it is the portion of this road finished and in operation, or what has been termed the first division, stretching from Jamaica to a point opposite Jerico, now termed Hicksville, that I propose to describe.

The Long Island Railroad then branches from the Jamaica Railroad at Jamaica, at a point 10·83 miles from the South ferry, Brooklyn; the curve which at this point connects the terminus of the Jamaica Railroad with the due course of the 1st division of the Long Island road, has a radius of 5730 feet—the length of curvature is about 1100 feet, and this comprehends all the curvature on this division—the remainder is straight.

The entire length of the division is 15·34 miles, of which the equivalents of curved and straight line are respectively 0·21 miles, and 15·13 miles. The profile will show the different inclinations, which are likewise exhibited condensed in the following table:—

INCLINATION.

Rates per mile in Feet O. or level.	Rise Miles dec.	Fall Miles dec.	Total Miles dec.
5·28	1·89		5·24
7·92	1·01		1·89
10·56	2·84	0·19	1·01
13·20	3·60		3·03
15·84	0·57		3·60
			0·57
	9·91	0·19	15·34

The following table will show the position of these inclinations without reference to the profile. The stations are 100 feet apart.

From Station	To Station (A)	Rate per 100 feet. Feet.	Rate per mile. Miles.	Elev. of 2d column (A) about stat. O. Feet.	Distance of 2d column from stat. O Miles.	Elev. of 2d column above high water Brooklyn Feet.	Distance of 2d column from Brooklyn. Miles.
0	0			0·		44·	10 83
0	20	0·20	10·56	4·	0·38	48·	11·21
20	70	0·00	0·00	4·	1·32	48·	12·15
70	80	0·20	10·56	2·	1·51	46·	12 34
80	110	0·30	15·84	11·	2·08	55·	12·91
110	240	0·20	10·56	37·	4·54	81·	15 37
240	340	0·10	5·28	47·	6·44	91·	17·27
340	410	0·00	0·00	47·	7·76	91·	18·59
410	463	0 15	7·92	54·95	8·77	98·95	18·60
463	620	0·00	0·00	54·95	11·74	98·95	22·57
620	810	0·25	13·20	102·45	15·34	145·45	26·17

WIDTH.

The road is graded for a double track; the width of roadway is 28 feet in excavations and embankments. The stuff excavated consisted of sand and gravel; the sand was sometimes found pure, but more frequently intermixed. In one of the excavations near Hicksville, small veins of clay occurred frequently, crossing the track. These when they appeared on the road bed, were removed to a depth of 18 inches, and replaced by gravel. At the extremities of the excavations where the top soil and the road bed meet, the same process was pursued. The entire plain on which the division rests is a gravel formation exceedingly open and pervious to water; the surface water, or drainage of the country, escapes principally in this way. There are various hollows or depressions on the plain, with directions towards tide water, but so little of the surface water passes off ordinarily by the openings, that the natural sod is not broken, and there are no water courses apparent: this fact was taken advantage of in draining the railroad; pits were dug occasionally in the excavations into which the side drains were directed, and the unusual quantities of water produced during the spring, by the sudden melting of the winter snows, was thus easily carried off, nor did the water accumulate or overflow in the pits; these pits never reached the under current of fresh water, which evidently flows from the hilly side of the island to the sea, and from which the islanders derive their supplies for domestic purposes. This water is found at the Jamaica depot 28 feet below the road bed, but the road bed occurring in cutting there of about 6 feet in depth, it may be said to be 34 feet below the general surface of the plain at Jamaica. The top of the Jamaica well is about 45 feet above high water at Brooklyn; the bottom, or supply water of which we are speaking, is thus 17 feet above the sea. The well at the Hicksville depot is 72 feet in depth; the top of the well is about 147 feet above high water, and the bottom or water of the well is therefore about 75 feet above the sea. The Jamaica well, however, is distant from the salt water in the bay, only about 3 miles, while the Hicksville well is distant probably 10 miles: from these data, the descent of this underground flow, percolating through the gravel formation towards the sea, would be estimated at about 7 feet per mile.

SLOPES.

The side slopes in excavations and embankments, incline in the ratio of $1\frac{1}{2}$ horizontal to 1 perpendicular: this slope may be termed the minimum or sand excavations. I had an opportunity of trying the natural slope of gravel in an excavation of 40 feet in depth on the Boston and Providence Railroad; the gravel was very loose and free, consequently no picking was found necessary; the stuff rolled freely down to the feet of the laborers, as the excavation proceeded; the side slopes formed of themselves with a little trimming at top. While the excavation was in progress, I tried with the level, the natural inclination of these side slopes, before they had been trimmed or touched, and after allowing them to stand about eight days exposed to a June sun, whereby any moisture was removed, and the particles of gravel being perfectly dry, could not but have attained their natural position: under such circumstances, I found the slope to exceed by a small fraction, the proportion of $1\frac{1}{2}$ to 1. In some experiments, on the flow of sand through tubes, as detailed in a late Journal of the Franklin Institute, the experimenter gives from 30° to 35° as the natural inclination of sand, equal to about 2 to 1; probably the sand experimented on was finer and drier throughout than the sand generally

found in the quarry, or the quantities experimented on may have been too minute to admit of very correct results. On the slopes tested by one, there would probably be only 3 or 4 inches of the sand on the surface entirely free from moisture. All sands and gravels found in their natural beds are combined with a certain degree of moisture, and when this does not occur in excess, so as to appear as water, it renders them, as every one must have observed, more tenacious or solid than if they were entirely free from it: the slopes of sand of this description, will not therefore have attained their maximum until lengthened exposure has allowed the heat to penetrate to its maximum depth, and consequently, the dry crust or surface of dry sand to have reached its limit: this depth, however, is never great. These side slopes, except in some of the excavations finished during the winter months, were very neatly trimmed and finished by the contractors. In one of the excavations, the slopes were covered with the soil which had been previously removed from the surface of the excavation; they were then sown with grass seed; the seed speedily rooted, and these are the only slopes which retain the figure given, or possess now any thing like a regular appearance.

DITCHES.

Ditches were opened on each side of the roadway by the contractors for the graduation, where the graduation was finished before the commencement of winter; where the graduation was finished during the winter months, the opening of the ditches, in consequence of the great expense attending excavation in winter, was delayed until the ensuing spring: the general suspension of public works, however, which occurred then in consequence of the disastrous state of commercial affairs, deprived the engineer of the opportunity of perfecting them. The manner in which they were formed, and the dimensions, so far as completed, will be understood by reference to the cross section of the finished roadway in cutting (fig. 1.)* There being but one track laid in the meantime, and that on the south side of the centre line, there remains considerable unoccupied space on the north side, which is taken advantage of to increase the dimensions of the drain on that side. On the south side, the space between the outer rail, and the foot of the slope, is 6 feet: between the extreme end of the sleeper, and the foot of the slope, from 4½ to 5 feet: this space, when the ends of the sleepers have been sufficiently covered, admits of drainage of only one foot in depth, estimating from the graded surface of the road bed; estimating from the top of the sleeper about 1 foot 4 inches; the sleepers average 7 inches in depth; we have, therefore, when the ground sill is single, and 3 inches thick, a difference of 6 inches between the bottom of the ground sill and the bottom of the side drain: when the ground sill is 1 inch in depth, a difference of 5 inches; when the ground sill is double throughout, or when with the single ground sill, additional pieces occur, as at the junctions of the sills of the rails, a difference of two inches. On the north side of the road, the drain is two feet in depth. These drains, where the side slopes have not been soiled, easily fill up, and require frequent renewing: the sand and gravel, of which the side slopes are formed, being very easily displaced. On the tops of the excavations, and within the fences, small drains, or cut waters, are formed, the stuff or turf excavated from which, is thrown up as a small mound on the outside; this prevents the surface water from the fields from running down the slopes.

* The Engravings referred to, will appear in our next number.

PRICES OF EXCAVATION.

The prices of graduation were for the lower half of the division, 17 cents per cubic yard; excavation and transportation for the upper half, 18 cents per cubic yard. These were the contract prices, and so far as the work was completed without delay during the summer months, they proved amply sufficient. A considerable portion of the graduation was, however, delayed many months by unforeseen circumstances, and a considerable portion completed during the winter of 1836–7; for such portions additional allowances were made, varying with the amount of additional labor employed. The following list of prices were found to approximate very nearly to the truth, when ordinary labor averaged a dollar per day.

COST OF EXCAVATION OF GRAVEL OR SAND.

Transportation in ft.	Temporary Railroad and Cars.	Carts.
500		14 cents.
800		17
1000	17 cents.	19
1500	19	20
2000	21	23
2500	22	25
3000	23½	28
3500	25	31
4000	26½	34
5000	28	38

For the year 1835 this scale would have been two cents less per cubic yard; the prices must of course be somewhat modified by the quantities of earth to be removed.

FENCES.

The fences are placed at least eight feet beyond the top of the slopes in excavations, or bottom of the slopes on embankments—the fence is uniformly a post and rail fence—the posts five feet in height, and distant eleven feet apart—the rails four to each post; the fencing was done for $1 25 and $1 50 per panel of eleven feet, the contractors providing every thing.

FOUNDATION.

The graduation being finished according to the dimensions described, and all earths removed from the road-bed other than gravel, and replaced by gravel, no further preparation was made for the foundation of the superstructure; the foundation, therefore, on which the superstructure rested consisted throughout of gravel or sand.

LAYING.

Ground sills were laid throughout; on the greater part of the road, and universally on the embankments, double planks were laid for ground sills, consisting of three inch planks laid the one above the other, and breaking joints (see figures 2, 3 and 5, D): where single planks were laid, they consisted of either three or four inch planks, and in this case additional pieces were laid at the points where the planks met, and also at the points where a junction of rails occurred: in the first instance, viz., where the

planks met, the additional pieces consisted either of a piece of four feet in length, laid below, and so as to receive two feet of each plank, as represented at A fig. 2 and 3; or of two separate pieces of about three feet in length, one laid below the end of each plank and at right angles to its directions as represented at B, (fig. 2 and 3). In the second instance, viz., when the *rails* met, two additional pieces of plank were laid, one on each side of the ground sills, of three feet in length each, as represented at C (fig. 2 and 3), thus affording additional bearing to the junction sleepers. In either case, whether of double or single plank, the sills were so laid that the surface, when perfected, should be two inches below the original grade, or surface of the road-bed; small trenches were therefore dug in the first place to receive the plank of depth to correspond with the depth of plank and data above given, varying, however, occasionally to the extent of an inch, so as to comprehend different classes of sleepers. The bottom of this trench was neatly smoothed, and the plank being laid in it, the gravel was rammed along the sides, so as to equalize as much as possible the bed throughout; the plank itself was then rammed thoroughly with wooden rams, of probably 30lbs. weight, such as are used by paviers in consolidating the stones of causeways in public streets; every inch of the plank was slowly submitted to this process, and it was easy to know as the workman advanced, from the sound of the blow, whether the plank rested solidly on its gravel foundation. The ground sills having been thus prepared, stakes were driven to the grade line of the surface of the sleepers, varying with the different parcels of sleepers from six to eight inches above the ground sills.

SLEEPERS.

The sleepers having been laid in their proper places, and with solid beds, the heaviest sleepers placed at the points of junction of the rails, the surface of the sleepers was prepared for the rail; this was done by paring the sleeper with an ordinary carpenter's adze very neatly, until the proper size was attained; during the process, a straight edge of the length of the rail (15 feet) was frequently applied, and all the sleepers cut for either rail, so as to correspond correctly with this test and grade *line*; there was, therefore, no moving or raising the foundation after its first and best preparation; its uniform solidity was thus far secured; neither were the individual sleepers allowed to be raised from the ground sills, by placing slips of wood or shingles beneath them. When the workmen by accident or carelessness pared or cut from the surface of the sleepers too much, so that a space existed between the straight line and that surface, the sleeper was removed, and replaced by a deeper. The sleepers having been thus prepared, stakes for the alignement were correctly given, and the laying of the rails proceeded next; in the process of cutting the sleepers, the junction sleepers had been cut deeper than the others, to receive the plate or chair, which is laid below the rail only at these points; the vertical position of the plates is therefore correctly adjusted in that process; they are, however, left loose until the rails have been laid in their places and approximated to the alignement of the load; the rails on either side being adjusted, the spikes are driven into the junction plates, the alignement of the rails is then further approximated; the spikes are now driven to about half their depth on the intervening sleepers; the alignement of the rail is then further corrected; the spikes are now driven home, the direction of the rails perfected, and the junctions examined and corrected, where necessary; the track is next filled in with

gravel, covering the sleepers to the depth of about one inch; the ends of the sleepers are covered to the same depth; the ditches are now examined and cleaned out again, where necessary, by the contractor, for the laying, and the road is considered fit for travel. The laying of the superstructure was contracted for, at $2 62½ per rod; it was not completed, however, for this price, having been partly laid during the winter months, when the hardening of the ground by the frost greatly increased the amount of labor necessary, as well as greatly reduced its value when finished, since no winter work can be so permanent or perfect as that which is done during summer. It may be added, that in consequence of this contingent and extraordinary expense, affecting more or less all the operations on this division, I am unable to give so useful a return of the cost, as otherwise would have been possible, since the actual cost in this instance, if it could be given, would form no criterion or guide in the construction of similar works. All the prices will be given which are not affected by this contingency.

CHAIRS.

It has been mentioned that plates, or chairs, were laid only at the points of junction of the rails; the first mile of the road is an exception to this remark: there, an additional plate was laid at the centre of the rail, this additional plate was intended to allow for, and secure the free contraction or expansion of the rail, with the varying temperatures of summer and winter; the same variation was afterwards provided for at a less expense, though probably not so well, by a single plate. Fig. 9 is a cross section, exhibiting the mode in which the chairs receive the rail on all the plates used; the dimensions are marked in inches on the figure; fig. 6 exhibits the form in plan of the intervening plate spoken of, and which, as there were five sleepers to every rail, did not occur precisely at the centre of the rail, but at the third sleeper, nine feet from the one end of the rail, and six feet from the other; the holes *a a a a*, receive the spikes, and secure the rail to the chair; the small projections *b b*, are level with the sides or deepest portion of the chair (see fig. 9): these projections correspond with notches cut in the rail, of the same form as those represented at the end of the rail in fig. 11, except that for the chair in question, they occur near the centre of the rail, and in this case the rail was not cut at its end. In laying the rail, the notches just described fitted into these projections, and secured the rail at this point; a sufficient allowance, however, being always made while laying, for the expansion of the rail, and the junction plates in this case being quite smooth, the rail was at liberty to expand either way from the centre, where only it was permanently secured from lateral motion by this centre chair. The additional expense consequent on the use of this centre chair having been objected to, it was dispensed with, and the variation of the length of the rail was afterwards provided for by a modification of the junction plate, which in the other case had been smooth, by which the end of the rail was fixed and prevented from moving longitudinally, without carrying the chair and sleeper with it, while the other end was left free to move to the extent of the space left in all cases while laying, for this particular end. This space in the depth of winter was estimated at ¼ of an inch, and on that part of the superstructure which was laid in winter, this allowance was uniformly made at every junction, by inserting a piece of metal of the given size, and driving the rails close upon it; the laying being perfected, the slip of metal was removed. In the warm summer months, no allow-

ance was made, and in the temperate months of autumn $\frac{1}{16}$. Fig. 7 shows the junction plate which accompanied the centre chair, fig. 6, and which presents no obstacle to the longitudinal motion of the ends of the rails. Fig. 8 is the junction plate adverted to above, and which secured permanently the one end of the rail; in this case the projections *b' b'* instead of being placed in the centre of the chair, are on one side of it: the notches *b b* in the rail, fig. 11, fitted into these projections, and the chair being firmly secured to the sleeper, prevented the motion of the end of the rail; the other end of the rail, however, was not so secured; it rested on the side of the plate corresponding to the opposite of this plate, *c*, fig. 8, and which was therefore smooth; the rail was therefore at liberty to move (to the extent of the space left for that purpose) in that direction. In the case of this chair, the expansion and contraction, and therefore the longitudinal motion of the rail was practically about double of what it would have been with the centre chair; if the contraction amount to $\frac{1}{8}$, this contraction with the end chair was concentrated on one end; on the centre chair it was divided, occurring half at the one and half at the other; the centre in the last case partaking in some degree of the nature of a neutral point, and thus exempt from the strain which must exist in the other case. The centre chair weighed 6lbs., the corresponding junction plate 8lbs, the junction plate used without the centre chair 8$\frac{1}{2}$lbs.; the prices paid for these castings were 5 and 5$\frac{1}{2}$ cents per lb.

SPIKES.

There were three descriptions of spikes used as represented in figures 12, 13 and 14; *f f*, fig. 12 are different views of the same spike; there were but a few hundred pounds of this spike used on the road as an experiment; it was manufactured in England, apparently by hand, and although exhibiting more workmanship than the spikes used in this country, was offered, I think, at the same price; the head was case-hardened, and the sides ragged, so as to take a good hold of the timber into which it should be driven; these ragged points it was thought at the time would prove rather a disadvantage, from their cutting the fibres of the wood, but experience has shown it to be the most secure spike driven; it weighed probably a little over eleven ounces, for I am unable to state its precise weight. The spike of fig. 13, was manufactured by machinery, at Mr. Henry Burden's works, Troy; it was delivered in New-York at 8 cents per lb.; this spike was made from $\frac{5}{8}$ inch square bar iron, was about six inches in length, pointed and headed as shown in the sketch, and weighed 12$\frac{1}{2}$ ounces. The spike of fig. 14 was made from $\frac{9}{16}$ bar iron, by Mr. William Blackington, of Attlebury, Massachusetts, it was delivered in Providence for 7 cents a pound, and weighed 9$\frac{1}{2}$ ounces; it was about 5$\frac{1}{2}$ inches long, pointed and headed as the last, and like it manufactured by machinery. The heads of the two last described spikes were liable to break occasionally in driving, a fault from which the first mentioned spike was free. The form of the head of these spikes will naturally suggest the mode in which it secured the rail to the sleeper: on the plates at the junction of the rails, four spikes were used; on the intermediate sleepers, three spikes were driven, two on the outside and one on the inside of the rail, as shown in fig. 3.

RAILS.

The rail used was of the same pattern as the Boston and Providence rail (an inverted T) but heavier; it weighed on an average 55·4lbs. per

lineal yard. Fig. 10 shows the form of this rail: the width of the top or bearing is 2¼ inches, the depth of the rail 3¼, and the width of the bottom 4 inches; the length of each rail is 15 feet. These rails cost in Liverpool (1836) £14 10*s* per ton. The other expenses attending the rails, such as the freight and primage, the harbor dues, agencies, insurance,&c. I have not been able to obtain with that accuracy which would justify my presenting them.

MASONRY.

The masonry on the road consists of road bridges, culverts, and cattle guards—these varied in size with the exception of the distance apart of the abutments of road bridges crossing the railway, which was uniformly 28 feet. There is no rock found in site; the stones used for building purposes are procured from boulder of granite found in the hills, and which do not occur at all on the plain over which the railroad passes; these are scarce and proportionally valued; the distance which the stones required to be transported varied from 2 to 5 miles. The dry masonry of which the cattle guards were formed, cost from 3½ to 4 dollars per perch; the mortared rubble masonry of which the bridges and culverts consist, 4 to 4½ dollars.

REMARKS.

I have purposely reserved for this place such remarks as suggest themselves with regard to the details of the work, to enable me to make the preceding description of the road more succinct and clear, as well as to avoid the confusion or annoyance consequent on introducing in that place observations partly conjectural,and therefore to many persons both inappropriate and uninteresting; I shall make no apology for noting such here.

To enable those not familiar with the peculiarities of Railroads to judge of the value of inclination independent of the controversies which agitate the public mind on the subject of locomotive engines, I would refer first to the strain, which such engines in their action communicate to the road, and which, it is very palpable, will induce a comparative estimate of the wear and tear, or of the repairs on the road and on the engine also, but at present I refer simply to the road. It will be very evident to any mind that if the rails immediately under an engine, instead of being fixed, were loose, and further, if they lie on rollers, the action of the piston and wheel of the engine, instead of creating motion in the machine, would communicate motion to the rail; the engine would remain at rest, while the rail would move from beneath it; if any force were now applied to this rail sufficient to detain it in its place, this force would obviously measure the longitudinal strain, which the action of the wheels of the engine communicates to the rail, and which strain is resisted by the sleepers, blocks, or superstructure of whatever description, which secures the rail in its place; whenever, therefore, from the imperfection of the superstructure, from the weight of the engines employed, or from their inappropriate loads, or rapidity, the rails and spikes are loosened, and the solidity of the road destroyed, the strain is very obviously greater than the strength of the particular road will warrant, the power or speed in use is obviously not in proportion to the qualities, or the properties of the road, and there must consequently exist a constant and unreasonable expenditure for repairs. It may be said that if we apply this mode of reasoning to the generality of roads, not excepting the Long Island, we should infer blame somewhere; the assertion is not less true; there are few roads in this

country, at least, for we cannot assert of Europe what we do not know, on which the carriage and power employed, are adapted to the nature of the particular road. Roads, therefore, when finished, are frequently only nominally so; they may be said to be all the while making, since they are all the while requiring an unnatural and disproportioned expenditure for renewal and repair. It cannot be doubted that a better economy would arise from proportioning the engine employed, and the weight carried, always to the powers of the road; and since the strength of a road is equal throughout, the same on the level as on the ascent, a considerable portion of this power will be found due to, or lost by the inclinations existing, whatever these may be; we shall now state as succinctly as possible, and referring solely to the experience of others, what the amount of this strain may be for different inclinations.

The force of traction on a level has been estimated in England by different engineers, at from 7 to 9 lbs. per ton; it has been estimated by McKnight, on the Baltimore and Ohio Railroad, at 10 lbs; it varies on different roads, and will always be greater on a wooden road with plate rails, such as the Baltimore and Ohio, or the Paterson Railroad, than on a road with the heavy edge rail, such as the Camden and Amboy, or the Boston and Providence roads. We shall assume it here at 9 lbs., although it probably exceeds that on most of the roads in this country. If 9 lbs. then be the force required to move a ton, or a carriage of a ton weight, on a level Railroad, we have to ascertain the additional force due to any given ascent; this varies with the sine of the angle of inclination, or if the inclination be 1 in 100, the fraction $\frac{1}{100}$ will express it, and the additional resistance on an ascent of this inclination, will for one ton, be $2240 \times \frac{1}{100}$ or $\frac{2240}{100}$ or 22·4 lbs.; this value is entirely due to gravity, and is independent of the friction; the friction or resistance on a level, which was estimated at 9 lbs., must be added, giving a total of 31·4 lbs. for this inclination.

There are some considerations which would slightly increase this amount, but the above will be a sufficiently close approximation for our present purpose. The following table will present the forces required to move a ton on the different ascents of this road, as well as on higher ascents for the advantage of further comparison.*

Inclination in feet per mile.	Length of plane per foot vertical.	Resistance of gravity in lbs. per ton.	Resist. of grav. & fric. combd. or tot. r. in lbs. per ton.	Total resistance for a load of 50 tons.	Vel. of engine req'd to move a load of 50 T.
0	1 m	0	9	450	4
5·28	1 m 1000	2·24	11·24	562	5·
7·92	" 666	3·36	12·36	618	5·5
10·56	" " 500	4·48	13·48	673	6·
13·20	" " 400	5·6	14·6	730	6·5
15·84	" " 333	6·72	15·72	786	7·
20·	" " 266	8·48	17·48	874	7·8
30·	" " 176	12·73	21·73	1086·5	9·7
40·	" " 132	17·	26·	1300·	10·7
50·	" " 105·6	21·21	30·21	1510·5	11·6
60·	" " 88	25·5	34·5	1725·	15·4
70·	" " 75·4	29·71	38·71	1935·5	17·2
80·	" " 66	34·24	43·71	2185·5	19·5

* This table is merely intended for the general reader; to convey to him a fair impression of the effect of inclination, without detailing the various secondary causes, which would modify the table, and also extend it so much, as probably to induce him to pass it over altogether.

The 6th column is estimated on the supposition that the adhesion is $\frac{1}{12}$ and that the weight on the driving wheels is $\frac{2}{5}$ of the whole weight of the engine; the weight on the driving wheels of any particular engine being known, its power on any of the above inclinations may be inferred; for, dividing the given weight by 12, the adhesive power will be obtained, and dividing this quotient again for any particular inclination by the corresponding amount in the 4th column, a very close approximation will be made. We perceive by this table, and the data given, will enable any one to verify it, that on a rise of 20 feet per mile, the resistance is nearly doubled, on a rise of 40, nearly tripled, on a rise of 60, nearly quadrupled, &c.; we see also, that for a load of 50 tons, the adhesion necessary on a level, is 450 lbs., or the strain communicated by the driving wheels of the locomotive to each rail, would be 225 lbs.; in other words, it would require a force of 225 lbs. retaining the rail in its place to ensure the motion of the locomotive and train; on a rise of 20 feet per mile, however, there would be a total strain communicated by the driving wheels of 874 lbs., or the strains on either rail, on which these wheels respectively rested, would be 437 lbs.; or it would require a force of 437 lbs., retaining the rail in its place to ensure the motion of the train; this force is nearly double of that required for the same load on a level; the strain, therefore, is nearly doubled, and were we to proportion the strength of the superstructure to the strain, which it is required to meet, we should, on a rise of 20 feet per mile, make it twice as strong and massy as on a level; on a rise of 40 feet, thrice as strong; on a rise of 60 feet, four times as strong: on the contrary, the superstructure is of the same strength throughout. We see, therefore, how trying and deteriorating great inclinations are when compared with moderate, and having sufficiently understood what has been said, can easily understand the great repairs which heavy grades and heavy engines must necessarily ensure, while the strength of the road is not proportionally increased to meet the additional resistances. While horses were employed on railroads, this strain did not exist; the power of the horse was applied to the horse-path, or centre of the track, the weight of the carriages in that case, and the occasional lateral thrust from the wheels frequently rubbing against the rails on the straight lines, and always on the curves, were the only resistances which the superstructure had to contend with; there was no longitudinal strain on the rails, such as exists now in consequence of the use of locomotives; the resistances then were simply the direct weight, and the occasional lateral thrust spoken of.

In using locomotives, the resistance due to their peculiar action, is therefore entirely new and additional. We see then, that without reasoning particularly on this new resistance, experience has increased the strength of Railroads very greatly since the introduction of these machines; the weight of the rail has been nearly doubled; the weight and size of the bearings or blocks, has been more than doubled; the necessity of a massier and correcter superstructure has been gradually unfolded, and the road itself from being considered but a better kind of common road, is now gradually and correctly being associated with, and considered as a piece of very nice machinery, requiring in its arrangements and management, as much attention and care as the locomotive itself.

CURVES.

The amount of resistance due to curvature on this division is not great; there is but one curve, that which occurs at the departure from the

Jamaica Railroad. The radius of this curve is 5730 feet; I am unable to say correctly what the resistance on such a curve amounts to. Mr. Knight of the Baltimore and Ohio Railroad gives the resistance on a curve of 400 feet radius, as 5lbs. per ton; on a curve of 1000 feet radius, 1lb. per ton; these statements are the results of experiments which, however, I have not seen minutely detailed; to understand the value of such experiments, we require to know the diameter of the wheels and the distance apart of the axles of the carriage, the speed, and also the difference of level of the rails on the given curve. The wheels in use on the Baltimore and Ohio road are of small diameter, compared with those on other roads; the axles are also placed closer; these arrangements are consequent on the great amount of curvature on that road; on such roads as use larger wheels with the axles further apart, the resistances on equal curvatures will obviously be much greater. The wheels used on the burthen cars of the Long Island Railroad, are 36 inches diameter, and the axles 60 inches apart; the wheels used on the Baltimore and Ohio Railroad are, I believe, 30 inches diameter, and the axles not more than 40 inches apart.

WIDTH.

The first division of the Long Island Railroad, it has been already stated, is graduated to a width of 28 feet, and intended to accommodate two tracks. The width of the Boston and Providence Railroad is 26 ft; of the Stonington Railroad, 26 feet; of the Jamaica Railroad, 24 feet; 28 feet was adopted on the first division, because the stuff excavated being entirely composed of gravel and sand, the ditches would be more liable to fill up and choke, than when they are formed in stiffer earths, such as frequently occur on these other roads; a better reason, however, was the confessed insufficiency of the width above-mentioned, and which are generally adopted, as respects the space available for the drainage of the road. To appreciate this remark, the paramount value of efficient drainage must first be understood. Among engineers this advantage is sufficiently felt; it is not, however, sufficiently acted on, because the public is unwilling to countenance the additional outlay which would be required to meet the end, on the evident belief and feeling which prevails that the amount of capital now expended on railroads is fully as much, probably more, than, considering the other important interests of the country calling for such aid, even their very great importance entitle them to. Admitting this supposition, for the present, to be true, and therefore that the public had better meet the yearly deductions from the rents of such roads consequent on the present very inefficient state of their drainage than advance the additional capital which would be necessary to obviate this evil. The question is naturally suggested whether the present mode of graduating roads for a double track, where only one will in the meantime be laid, and when one will for many years satisfy the traffic and travel, might not be changed or modified for another, which should contemplate in the first instance but one track with numerous passing places, and occupy for this one track a sufficient width to ensure an efficient drainage throughout. To enable us to understand and answer this question, we must first be able to judge correctly of what amount of business a single track can accommodate, and in judging of this, we should be justified in taking into account a more methodical and perfect system of management than generally obtains at present, and which is gradually being introduced, and will very soon be in operation, at least

on some of the northern roads, such as the Boston and Lowell, &c. There is one difficulty, however, which such roads as the Boston and Providence, the Stonington, and the Long Island Railroads have to contend with, and which must either be modified so as to meet whatever system or arrangement may be introduced, or all arrangement and its advantnges must be sacrificed to this other contingency; I allude to their connection with steamboats. The times of starting of the steamboat trains correspond at present with the arrival of the steamboats, and the time of the arrival of the steamboat is very uncertain, varying in the best weather from one to two hours; the train is always ready to start on the arrival of the steamboat, and it seems understood and expected that no delay should occur at the landing. If the entire railroad in advance of the train is empty, and purposely kept empty, neither danger nor inconvenience can arise from pursuing this course; but if the road is not empty, if on the contrary, it is known that a train or trains are on it, and if the time of starting (from the other end) of these trains is known, their place of meeting with the train about to start must also be known, and if that known point does not occur at a turn-out, what advantage is gained by starting exhept at the hour and minute which will insure the meeting of this train with the other at a place where provision is made for their passing. The trains move at very nearly uniform velocities, and may always be regulated so as to reach the turnouts at stated times from the hour of starting; if, therefore, the steamboat train starts at any intermediate time, one of two things must occur: either that the trains will meet where they cannot pass, and one or other must consequently return, by which a little more time will be lost than had the delay been purposely made at the starting point; or otherwise the engineer of the locomotive, knowing his position on the road will purposely delay, by moving at slow rates, so as to insure the proper point of meeting, and thus nothing is gained in point of time, while the contingency of meeting an extra train is increased by the increased time which the engine has purposely dissipated on the road. When the road is not empty then, there is nothing to be gained (without, indeed, sacrificing the time of the opposite train in lieu of your own) by starting, except at times corresponding with the turnouts on the road, or at times which running at the usual rates will insure their meeting only at these points. If these remarks are understood, it will also be perceived that the danger of two trains unexpectedly meeting would be greatly lessened by pursuing the other course, and by a still more systematic mode of proceeding may be all but entirely removed. When a railroad is situated inland and unconnected with steamboats, the difficulty we have spoken of will not be known, and no difficulties or objections can consequently arise from such a source. This is not the situation of the Long Island Railroad, and it must therefore, as well as all roads similarly situated, incur an additional outlay, and prepare additional conveniences to reduce this evil as much as possible, without sacrificing, on the other hand, the palpable advantages which regularity ensures, and without which no road can be either very safe or very profitable. This can only be done by increasing the available times of starting, and hence the number of passing places which would otherwise be necessary. The evil cannot, however, be entirely remedied, and there must be a loss, less or more, at the steamboat end, and corresponding with the convenience prepared.

(To be continued.)

From the National Gazette.

Copper for Steam Boilers.

The tenacity of copper at ordinary temperatures, as demonstrated in the report to Congress already referred to, is on an average of nearly seventy experiments, 32 826 lbs. per square inch. The process of rolling it appears gives to this metal such a degree of uniformity, that though different specimens may be found to vary from each other as much as from 30,400 to 34,300 pounds to the square inch, or nearly twelve per cent, of the above mean, yet in the *same specimen* the greatest difference in the strength at any two points is not more than 4 8-10 per cent of its mean strength.

The trials to prove what portion of the force necessary to break any bar of copper was required to affect permanently its form, resulting in establishing about *two-thirds* of the breaking weight, as the part in question.

The *extensibility* of copper is so considerable as to allow a bar an inch wide, aad three-sixteenths of an inch thick, to be stretched from forty to forty-four per cent. of its original length without breaking—but the amount of elongation depends in a great measure on the temperature. A bar broken at 81½ degrees was elongated before giving way, thirty-four times as much as when broken, in another part, at 912 degrees.

The influence of temperature on copper is, to reduce its tenacity by every increase of heat, so that if the strength at 32 degrees Fahrenheit be known, the rise of temperature above that point marks very nearly the weakening of the copper according to the law that *the cube of the elevation of temperature is proportionate to the square of the reduction of strength.* This gives, at the temperature corresponding with ten atmospheres of pressure on the safety valve of a steam engine, (359 degrees 4,) a reduction of 12 34-100 per cent. from the strength of copper at the freezing point. At 548° 1 Fahrenheit the loss is 25 per cent.; at 851° 6 50 per cent., and at 1235 (a red heat daylight,) 88 6 10 per cent. From these data a table may be calculated, exhibiting the strength of this metal at any temperature, and in connexion with the table of pressures of steam for the same temperatures, will enable us to determine the proper thickness of metal to sustain any required force. Suppose the strength of copper to be 33,000 lbs. per square inch at 32° Fahrenheit, its tenacity in pounds, for any temperature will be found by *cubing the number of degrees of Fahrenheit above thirty-two, extracting the square root of that cube—multiplying the root by the decimal fraction* ·703563, *and substracting the product from* 33,000.

Extensive tables adapted to various pressures used in steam-boilers have been calculated on the basis of this rule, which together with the demonstration of the law, will appear in another form. They will, it is hoped, prove useful for those who would construct boilers on correct principles. By extending the table of elasticities of steam at different temperatures, published a few years since by the French Academicians, until we reach a pressure of 1000 atmospheres or 15,000 pounds on the square inch, we attain a temperature of 962° 38′, at which temperature copper would have a tenacity of only 13,033 pounds per square inch.

The research in question, therefore, now puts us in posession of the means of determining the exact degree of danger, resulting from any known temperature in a copper boiler. The fomula of the French Aca-

demicians is preferred, because it is founded on the most extensive series of observations hitherto made relative to the elasticities of steam at different temperatures, being carried, by direct experiment to twenty-four atmospheres. The inquires prosecuted in this city have extended the examinations of the relation of *tenacity* to *temperature*, even to a much higher point on the scale, than had been done for *elasticity of steam on its temperature*, by the philosophers of Paris. It will be seen, by reference to the report, that the tenacity of copper has been tried at a temperature of 1032°, at which the pressure of saturated steam would be 1353 atmospheres, or would require a safety valve to be loaded to the amount of 20,280 lbs. to the square inch; while the strength of copper at that temperature, would be only 10,755 lbs. per square inch; so that if a boiler tube of one inch internal diameter, were made an inch thick of copper, (without rivets,) it would scarcely suffice to bear the strain which steam generated within it at that temperature would exert to burst it. It has been shown that when other things are equal, the liability of boilers to burst is directly proportionate to their diameters; and accordingly a cylindrical copper boiler of *any dimensions* must, in order to have the force of pressure within, in equilibrio with the tenacities without, at the temperature of 1032° Fahrenheit, have its interior diameter, or the metal must be as thick as the diameter of the cavity within.

Copper boilers are often made of very large dimensions, and sometimes apparently without proper regard to the pressure. It has been mentioned to us that those in the Pulaski, were of uncommon magnitude, but the data are not at hand for judging whether viewed in connexion with their thickness and the pressure used, it could not be considered excessive. It must be evident that *generators*, technically so called, that is, vessels to be kept at a very high temperature, to receive, at intervals, portions of water to be at once flashed into highly elastic steam, cannot advantageously be made of this metal.

To know how much water a boiler or any part of it when heated to a high temperature can expand into steam in a given *time*, we must know the weight of metal thus heated, the temperature to which it is raised, its specific heat, and temperature of the water injected. This subject was first examined by the writer in a series of papers "on the rapid production of steam in contact with metals at a high temperature;" the experiments were commenced early in the year 1830, and the first part of the results appeared in the American Journal of Science, (vol. 19,) for October, November and December of the same year. To that and subsequent numbers of the same work, the reader is referred for the effects of iron, copper, brass, silver and gold, when thus employed at a red heat to generate steam of atmospheric pressure. It may be added, that of copper about 11 pounds heated to a dull red heat will produce from boiling one pound of steam, and will at the end of the process be found at 212°. The *time* required will vary with the amount of surface of hot metal to which the water has access. In boiler-copper one quarter of an inch thick, and presenting only one face to the water, the time will be at most *one minute and a quarter.*—The *conducting power* of this metal is greater than that of iron. This circumstance, together with the diminution of strength by the temperature, renders the danger of allowing the water to fall below the fire level, sufficiently apparent.

New York and Albany Railroad.

In relation to this important work, a meeting took place at Dover, Dutchess county, on the 18th of August instant, which was attended numerously by the principal proprietors of land, and other gentlemen interested in the prosecution of the above work from the counties of Westchester, Putnam, Dutchess, Columbia, as well as others from Massachusetts and Connecticut, which was organized on the motion of Jonathan Aiken, Esq., of Pawlings, by calling to the chair pro tem., the Hon. Obadiah Titus, of Dutchess county; and Governeur Morris, Esq., of Westchester county, secretary.

The meeting having been thus temporarily organized, on motion of John M. Ketcham, Esq., of Dover, the chair appointed a retiring committee of three, to report the names of suitable persons to preside at the meeting; viz. Jonathan Aikin, of Pawlings, Dutchess county; George W. Miller, of Bedford, Westchester County; Daniel E. Baldwin, of Spencertown, Columbia county.

The committee recommended the following nomination, which was unanimously approved of;—

Joel Benton Esq., of Armenia, Dutchess county—President.

Hon. Obadiah Titus of Dutchess county; Ebenezer Foster, Esq. of Putnam county; Lewis Morris, Esq., of Westchester county; Thomas Taber, Esq., of Dutchess county; Charles F. Sedgwick Esq., of Sharon, Connecticut; Morgan Carpenter, Esq., of Dutchess county—Vice-Presidents.

Jacob Harvey, Esq., of New-York; John M. Ketcham, Esq., of Dutchess county; George W. Miller, Esq. of Westchester county—Secretaries.

Thus organized, on the motion of Charles Henry Hall of New-York the reports of the commissioner of the company, as well as of the engineers employed upon the various surveys were called for; whereupon Mr. Bloomfield, the said commissioner, responded in a very able detailed and very satifactory statement, prepared under the advisement of the executive committee of the company.

The detailed report furnished information in some measure unlooked for, and highly interesting, inasmuch as he there proved from the surveys made by the engineer, that the entire distance from Harlaem river to Albany will be less than one hundred and fifty miles; and upon a grade not exceeding thirty feet to a mile, $\frac{7}{10}$ will be level or under 20 feet; $\frac{2}{10}$ will range from 20 to 29 feet; whilst only $\frac{1}{10}$ in different places need exceed 30 feet with moderate cuttings and embankments. The report of the commissioner further stated, that he had been actively and successfully engaged in the procuring releases of lands on which to construct the road; that many large landed proprietors, situate in Westchester, Putnam, and Dutchess counties, had given releases of their property *gratis*, and in many instances the tender of *timber* for the construction of the road through their lands; at the same time, they came liberally forward and subscribed for stock of the company, in sums from one hundred to ten thousand dollars each. That the amount already subscribed in those counties, including New-York, exceeds six hundred and fifty thousand dollars, in addition to the original subscription, and the various agents on the line from the city of New-York to near Sharon, Con., had assured him (and a majority of them confirmed that assurance at this meeting) that in their opinion more than a million of dollars would be forthwith obtained.

The commissioner also exhibited a very satisfactory statement collected from gentlemen residing in the various counties through which the road will pass, as well as in the states of Massachusetts, and Connecticut taken from actual statistical data, which proved to demonstration that the receipts for the carriage of passengers, agricultural and manufacturing products, as well as of merchandize generally, will make a return thirty per cent. in gross, upon the probable amount of capital that may be invested in the putting the road into successful operation: and this without any *prospective* speculation upon the natural increase of population, agriculture, manufactures and trade.

The reports of the engineers, Mr. Morgan and Mr. Shipman, were much to the satisfaction of the meeting, and showed conclusively, that the New-York and Albany railroad can be constructed not only upon a most favorable grade, but at an expense far less than any railroad which has hitherto been laid down within this state. The following extract may serve to show the opinion of the engineer. "There is no railroad east of the Allegany mountains of equal extent that can be compared with the one in question, in point of mechanical advantages: and it is a very remarkable circumstance that in so long a line the rock cutting is so comparatively trifling."

The engineers presented to the meeting, maps and profiles of the entire route from Harlaem river to Greenbush, opposite Albany, (also of a line through Sharon and Salisbury into Massachusetts,) which served to prove the accuracy of their reports to the commissioner, and the executive committee.

The reports having terminated, the meeting was addressed by a number of gentlemen in a most eloquent and effective manner, showing throughout an entire conviction of their belief in the feasibility of constructing the road, and the facility of procuring the means of doing so.

Mr. Charles Henry Hall, the president of the company, being called upon, then addressed the meeting in a very animated and decided manner, setting forth the advantages of the road, the necessity of the entire co-operation of the counties through which it might pass, not only of the gratuitous furnishing of land, but in the subscribing of money; and clearly demonstrated the practicability of making the road and finishing it within a short period of time.

That among the advantages that would be derived from the construction of the road in question, would be the junction that would be formed with the 'Great Western Railroad' from Boston to Albany, via the Housatonic Valley, as also direct to, and with the Railroads from the west, terminating at Albany and Troy. At the same time, a union that may be made with the Danbury Railroad at the Connecticut line, also that of the Canajoharie Railroad, terminating at Catskill; which would naturally, and of necessity, form a continuous line of road from the west and southern tier of counties with that road, with branches terminating at Newburgh and Kingston. Mr. Hall adverted to the advantage that would arise in the carrying of the various mails, which would prove a source of great revenue to the company.

The Hon. N. P. Tallmadge, of Poughkeepsie, requested Mr. John M. Ketcham to state to the meeting his regret at not being able to unite in its deliberations, and at the same time to state his entire conviction of the propriety as well as the necessity of prosecuting the work in question, in order to throw open and perfect the communications by means of Railroads throughout the state. That at the date of the New-York and Al-

bany Rail Co. charter he had advocated it in the senate of this state, and since had no cause to change his opinion, being satisfied that all sectional jealousies should be acted on promptly and with unceasing industry and perseverance.

Jacob Harvey, Esq., of New-York, also addressed the meeting. He expressed his surprise, and gratification, at meeting so *large* an assembly, one far larger than that which first convened in New-York, in reference to the Erie Canal. He was particularly pleased to see so many farmers present, so much of the agricultural interest, the bone and sinew of the state, engaged in a work for the especial benefit of the *city*, which was tributary to the *country:* the agricultural leading the commercial interest. He was willing to place the city in the *second rank.*

He hoped there would be no discouragement, nor did he believe there would be, if gentlemen would remember the inauspicious commencement of the Erie Canal, which was pronounced a visionary and *impracticable project*, and to such an extent was hostility carried, that De Witt Clinton lost the vote of Herkimer county, because it was said that he had ruined many of the finest farms of that county by cutting a '*big ditch*' through them. He assured gentlemen that while he believed there should always be a *quid pro quo*, and that people could not be expected to give their land without an equivalent, yet that as in the case of the ruined farms of Herkimer county, the farmers could not, at this time, be induced to have the big ditch filled up; so, gentlemen by giving their lands to the New-York and Albany Railroad Company, would find that they would receive *more* than they *gave*, that there would be a large balance of benefits in their favor. After many other sensible and practical remarks, Mr. H. concluded by offering the following resolutions:

1st. Resolved, That this meeting view with great satisfaction the enterprising spirit which successfully pervades our sister states, Connecticut and Massachusetts, on the subject of railroads and their attendant advantages, and that we hail with pleasure the approaching connection of the Massachusetts 'Great Western Railroad,' with a connecting line from New-York to Albany.

2d. Resolved, That we congratulate the citizens of this state, and of its southern section particularly, on the manifestation of increasing-interest in railroads, which is daily giving earnest of a determination to unite in a system of inter communication, so auspiciously commenced in the north; —by which the resources of this state may be fully developed; proportioned to the enterprise of her citizens, and on a scale commensurate with their intelligence and wealth.

Charles F. Sedgewick, Esq. of Sharon, Connecticut, after prefatory remarks of the vast importance it would be to this section of the country to unite in a junction of railroad from thence to the line of the New-York and Albany Railroad, said, that he had observed in one of the resolutions a complimental notice of the states of Massachusetts and Connecticut in reference to their zeal, in relation to railroads. He was not acquainted with any gentleman present from Massachusetts: but, he expressed the thanks of himself and his associate, Col. King, in behalf of Connecticut, for the kind expression of the resolution which had been adopted, and he assured the meeting that those in whose behalf they appeared were zealous in directing their personal and persevering efforts in support of the great cause which they wished to see advanced. Mr. Sedgewick terminated by an eloquent and forcible appeal, which made a strong impression upon the audience.

Thomas Taber, Esq , of Dutchess county, after addressing the meeting, and alluding particularly to the necessity and importance of the farmers generally, ceding their land gratuituously, offered the following resolution.

Resolved, That the thanks of this meeting be given to the agents of the company, for the attention which they have heretofore given in procuring subscriptions and releases, and that they be requested to continue their exertions with as little delay as possible.

The Hon. Obadiah Titus, of Dutchess county, offered the following resolutions;

Resolved, That this meeting have the most entire confidence in the practicability of constructing the New-York and Albany railroad, and are fully sensible that the most important benfits will result from its construction.

That we have the fullest confidence in the integrity and ability of the gentlemen engaged as officers and agents in the management of said road.

On motion of Joseph D. Hunt, Esq., of Amenia, it was

Resolved, That the publishers of newspapers in the cities of New-York and Albany, and in the counties of Westchester, Putnam, Dutchess, Columbia and Rensselaer, be respectfully solicited to publish the proceedings of this meeting.

An amendment to this resolution was then submitted and carried, by Col. King, of Sharon, Connecticut, adding a request of the same import, that the Massachusetts and Connecticut newspapers be solicited also to publish the proceedings of the meeting. Adjourned.

Dover, August 18, 1838.

Internal Improvement.

Recurring to this subject, as we promised, we proceed to offer such suggestions as may aid in establishing a plan for extending the aid of the state to the Railroads now in progress. We have expressed the opinion (and we believe no one will doubt its correctness) that the state road will prove of little use if it stops at the Chattahoochie; we have further said it would be proper to carry out the views of the Macon Convention. Let us look at the prospect and probable cost of three lines of transportation from the end of the state road in De Kalb, one to Augusta, another to Forsyth, and a third towards West Point and Columbus.

The Georgia Co. has already finished its road a distance of seventy miles from Augusta, and within a year will be at Madison; it has expended over one million of dollars on its road, and must necessarily pay further large sums in carrying on its roads to Madison and Athens, and the other points contemplated by its charter. This company has a present capital of two millions, devisable between its bank and road, all of which has been paid in. With this capital it can probably complete the road to Madison, about ninety-five miles from Augusta. It has the right of extending the road from Madison to the state road, a distance of about 65 miles. It is quite certain, we think, that it cannot without an increase of its capital, extend its road beyond Madison, to say nothing of its other branches, and we fear that without the aid of the state, even with an allowed increase of capital, it cannot unite with the state road by the time of the completion of the latter.

The Monroe company has graded its road from Macon to Forsyth, has nearly finished laying the superstructure, and will within the present year, run locomotives between those places. This road is about twenty-five miles long, and will cost over $300,000. (We desire it to be understood that we do not pretend to be exact in distances; outlay of money, or cost of road of the companies which we notice, but we design to be near enough the fact for present purposes.) The capital of this company is $600,000, with liberty to increase it to twelve hundred thousand dollars, for the purpose of extending the road from Forsyth to the state road. The new stock is now advertised, and it will soon be determined how far the funds of individuals will be applied to the work. We earnestly hope that the subscriptions will be ample, but apprehend that the profits hitherto made in agriculture and merchandising, and the novelty, as yet, of the enterprise will, prevent capitalists from embarking to the desired extent. In connexion with this road, our own, the Central Railroad from Savannah to Macon, must now claim attention. The Central Company has, by charter, a capital of three millions, which it may divide between its road and bank,—more than one half cannot be used in banking, though all may be applied to the road, and, by the terms of the charter, the road must be finished by December, 1843. Only two millions of the capital have been subscribed, sixty-seven and a half per cent. of which has been called in, and that amount has been applied, $27 50 to banking, and $40 00 to road. The road is under contract for 100 miles—graded near 80 miles—finished about 40—and iron for 82 miles is paid for. Three locomotives with freight and passenger cars are in use, and other materials have been extensively provided. We understand that the expenditures including depots, right of way, and property for the road, amount to about $730,000. The contemplated cost of the road to Macon is about two millions. With the present capital subscribed, this company may, diverting the bank capital, build the road with the residue of the capital paid in, it may build the road and have a bank of about one million. The subscription of the remaining stock would ensure the building of the road by the 1st day of January, 1842, and, probably at an earlier day. But at present, it is impossible to procure from individuals a further subscription of one million, especially as by the charter (a most impolitic provision as we conceive) no foreigner can subscribe for stock. This company, then requires the aid of the state to enable it to finish its road by the time of the completion of the state road. The Monroe Company will require like assistance, for it will require about one million of dollars to carry its road to DeKalb.

The company, chartered with a capital of two millions to construct the other line from Columbus to the state road, has been duly organised and is about to commence the necessary surveys. We are not sufficiently acquainted with the country to say how great will be the length or what the cost of this line. We suppose the distance to be about 100 miles and the cost about one million.

We see, then, that about four millions of dollars would ensure the speedy completion of the three roads referred to in the commencement of our remarks. We think a less sum would accomplish the object. The immediate consequence of the completion of these roads would be to give large profits to the state road, and an overflowing public treasury. But it is not necessary that the state should actually expend one dollar of the amount. Let the state lend to the Georgia and Central Companies, each, $750,000—and the whole contemplated work can be acomplished in the

course of the next three years. Will the state be safe in making such a loan? Where is the security against loss? To these important enquiries we answer, that money or credit was never loaned upon safer security than can be given The *roads*, (we say nothing of other property, the amount of which will be great) of these companies will be worth at least six milions of dollars—they can be mortgaged to the state, with liberty to foreclose, if the principal and interest be not punctually paid as agreed on, or if even the interest be not paid liberty may be given to foreclose for the whole sum loaned. If by any casualty it should become necessary to foreclose the mortgages, and for the state to become the owner of the roads, the public will have the state work extended from De Kalb county to the cities of Savannah, Augusta and Columbus—for the comparatively small sum of three and a half millions of dollars. Does any rational man suppose, that with such a pledge given, any of these companies would fail to comply with the condition of the loan.

We respectfully ask public attention to this plan, for we see the great importance of having these three lines of road all finished by the day of the opening of the state road. One year's delay in the forging of any link of the great chain will be disastrous. We have rivals for the great prize of the western trade, and should neither slumber nor sleep. We shall be willing to yield our plan to any other which will speedily accomplish the great end in view. We will give our feeble aid, at all times, to make Georgia what she ought to be and what she can do —with little hazard, and simply by giving encouragement to individual enterprize—*the outlet of the great west.*

We have, in the preceding remarks, not mentioned the line of road from De Kalb to *Milledgeville*, not because we are unwilling to see that embraced in the general plan. We cordially agree, if the citizens of Baldwin and the other counties interested shall desire it, that the last mentioned road shall also be embraced, for, in truth, we were of opinion when the act was passed to build the State road, that provision should have been made for extending it to the seat of government at the expense of the State. We should be proud to see the State road so extended either by the public treasure or by individual enterprise.—*Georgian.*

Embankments from the Sea.

THERE seems to be no operation connected with agriculture which promises more immediate and important results than the reclaiming of submerged lands in the estuaries in our large rivers. Till within these thirty years, the sole object contemplated in embanking submerged grounds, seems to have been the exclusion of water from the surface of soil which required only to be protected from its occasional invasions, and kept dry merely to make it eminently fit for most productive cultivation. Within the last twenty years, a system has been entered on, and is now, in the Forth and Tay in particular, being carried out to the most astonishing extent, not only of bringing into a cultivable state lands already, but for the periodical submergence, fit for cultivation, but of causing rivers to precipitate their mud in convenient localities, and so of creating fields where nothing before existed but a gravelly river bed, covered by from eight to twelve feet of water every tide, of the most unprecedented and unlooked for productiveness.

In the Forth, 350 acres of this sort of land have been, in the last

twelve years, reclaimed by Lady Keith, at a cost of about £21,000, and affording an annual return of about £1,400, or nearly seven per cent. In the Tay, seventy acres have been recovered opposite to the shores of Pitfour, 150 on those of Errol, and twenty around Mugdrum Island, making in all 240 acres, at about an outlay of £7,200, yielding an annual rent of about £1,680, or upwards of twenty-three per cent. On the Errol estate alone, 400 acres are just about to be embanked, in addition to the above 150, all of which may probably be in cultivation before 1847. Off the shores of Sea-side, a wall just now being built, 800 yards in length, will effect the recovery of not less than 150 acres; and on Murie property, 50 acres might be taken in by seed-time 1838. The operations of the embanker, which began off Pitfour, 1826, will thus probably have been brought into cultivation before 1846, on a shore of not more than seven miles in length, no less than 810 acres of land, renting at from £6 to £7 per acre, or of a gross annual value of £5,670, and a gross total value, at twenty-five years' purchase, of £141,750. This is a clear creation of £117,450 of new agricultural capital, taking the reclaiming cost at £30 an acre. The junction of Mugdrum Island to the north shore would probably afford 1000 acres at a single operation, while thrice that surface might be obtained betwixt Errol and Invergowrie.

The capabilities of the Forth, over and above what has already been effected above and below Kincardine, are not much, if at all, behind those of the Tay, though no sufficient inquiry has been made to permit details to be gone into.

The basin of Montrose affords a surface of nearly 3000 acres, all capable of embankment, and which, by being relieved of the salt water of the ocean, which every tide at present overflows them and keeps them submerged for twelve hours out of every twenty-four, and irrigated by the fertilizing current of the Esk, which, for at least forty days every season, bears along with it not less than 1,800th part of its weight of the richest mud, might speedily be made not less productive than those of the Forth or Tay.

It is probable that between North Brunswick and Montrose are to be found the most favourable localities for embanking on the east coast of Scotland, if not indeed the only ones which could be made available with a sure prospect of profit. It would be at the same time well that the debouches of all our great rivers were examined, lest at the mouth of the Sprey, the Dee, the Don, the Esk, and the Tweed, might lurk localities equally accessible to the embanker, and equally unlooked-for, more than in the Tay or Forth thirty years since.

If the harbours on both sides of the Forth be examined, as low down as Dunbar on the one side, and Crail on the other; and those on the Tay down to Broughty Ferry; on the Esk to Montrose and Ferryden, larger quantities of silt will be found accumulating in each of them, quite as impalpable and fine, and probably, if freed of salt, as fertile as those deposited and taken in higher up the rivers. It is probable, then, that lands might be embanked much farther out in the estuaries than seems at present to be suspected, by much the greater part of the argilaceous flocculi which the river bears along with it being actually carried out to sea.

The various embankments hitherto completed have been constructed by those manifestly little acquainted with hydraulic engineering, with little concert amongst the proprietors, and without almost any recognition of general principles or systematic plan of procedure. Many anomalies are

consequently apparent in the now finished works, and many cases of useless expense and annoying inconvenience have arisen which it would have been most desirable and not difficult to have avoided.

On these and on many other grounds which must be apparent, but to enter into a detail of which would be much too tedious for the present memoranda, it seems most important that something should be done in the way of an historical account of all the embanking operations of any importance in Scotland, whether for the purpose of merely defending lands previously existing, but liable to periodical inundations, from tides or river freshes, or for the purpose of obtaining and enclosing accumulations of silt, which, but for the skill and industry of man, would have been wholly swept away.—*The Quar. Journal of Agriculture, Scotland.*

Wetumpka and Coosa (Ala.) Railroad.

We give the annexed extract from a letter, dated "Encampment, 25 miles N. W. of Wetumpka, Ala., August 24th," in order to keep our northern readers apprised of the progress of Internal Improvement in the Southern States—and with the hope that it may tend to urge on similar works in other sections of the country.

We take the present opportunity of renewing our request to Engineers to furnish us, at an early date, with a particular description, and complete statistical account of works now under their charge; but more especially of those which are completed, and now in use. They will find the commencement of a series in the present number—the Long Island Railroad, which is to be also published in a pamphlet, with lithographed illustrations, and will be for sale at this Office and at the Book-Stores.

We hope to follow it with a description of every Railroad in the Union; and if we succeed in obtaining them from authentic sources, we hope to be able to publish them all in a volume separate from the Journal; our success in the undertaking will depend, however, upon the prompt and kind attention of Engineers, and Gentlemen having the means, to our call for the individual descriptions.

☞ As a further inducement than a desire to have an account of many works of the kind included in such a publication, we will offer to each gentleman furnishing a proper and full account of any work which he may have completed, or may now be engaged upon and near its completion, a copy of the book when it shall be published.

"I had intended to draw up some brief account of the progress, prospects and general advantages to our State and the South, of this work (the Wetumpka and Coosa Railroad), but in consequence of a constant press upon my time, I am unable to do so at present. At some future day it may be convenient for me to fulfil my wishes in this respect. I will say, however, *en passant*, the graduation is progressing with as much rapidity as the circumstances of the times will permit. The timber for superstructure upon some five or six miles is upon the line—and the loca-

tion is now going on at this point, with the expectation of a speedy increase of force. The country through which the route lies is remarkably healthy—abounding in the best of timber, immediately contiguous to the line—and doubtless the stock will be very profitable."

Iron Steamboat on a new plan.—Mr. Ogden,. American consul at, Liverpool, writes to Mr. Caldwell, New Orleans, thus:

I had an opportunity, when Capt. Glover's ship, the Star, was in the graving dock, to take her measurements outside and in, the result of which was, the perfect conviction, on which I would stake my life, that with the engine I am putting on board my small boat, the weight of which with the boiler, water, and all complete, will not exceed from 10 to 12 tons, I can drive that ship upwards of six miles an hour, with a consumption of from two to three tons per day. The space occupied to be the after hold from the mizen-mast, not interfering in the least with her cabin or between decks, except where its chimney comes through, immediately forward of the mizen-mast. The two small roofs aft to communicate with the engine room, giving it the benefit of the two quarter cabin windows, and to be used for the berths of the engineers, &c. The wheels are through each quarter, will be six feet in diameter, and may be thrown in and out of gear at pleasure, so as not to impede the way of the ship when the engine is not in use.

Mexican Gulf Railrord.—An attempt is making to proceed with the enterprise of a railroad from New Orleans to the Gulf of Mexico. The company was chartered a year ago, and last March the state granted it a loan of $100 000, provided satisfactory security could be furnished. Books are now opened for the subscriptions. This road will pass through Bons Enfans street, thence following the Mississippi and the Terre aux Bœufs, as far as Lake Borgne, where a harbor will be established, and the main branch will traverse the point of land between the river and Lake Borgne, and strike the Gulf of Mexico, opposite Cat Island, where, by recent soundings, sixteen feet water have been found.

"During the first week after opening the London and Southamton railway, upwards of 5000 persons travelled by it; and during the second week the passengers exceeded 10,000, owing to the Epsom races. The regular and steady traffic on the road, referable to the part already opened, considerably exceeds the estimate formed by the Directors.—*Chronicle, London, June* 9.

An Important Invention.—Mr. Amory Amsden, one of our most respectable citizens, has shown us an invention for ascertaining the weight of the lading of canal boats, without removing the boat from the water, which it strikes us, will be of almost incalculable importance to the country. The apparatus is very simple, and can be constructed for a small amount of money.

We do not know that we can give an intelligible description of it, but we may possibly give the reader some idea of its operation. A hole is to be made through the bottom of the boat, in the centre, through which a tube is inserted that goes down into the water. Through that tube passes a

spindle with a buoy at the lower end. The buoy of course floats upon the top of the water that runs into the tube. The upper part of the spindle is marked and figured similar to steel yards. When freight is put on the boat, it sinks deeper into the water, and more water runs into the tube, which raises the spindle. For instance, while an empty boat is lying in the water, put 1000 pounds upon it, the boat sinks and the spindle rises to the 1000 pound mark.

If this invention prove successful, it will certainly be important, and ensure to Mr. Amsden both fortune and reputation. It will supersede the necessity of weigh locks, which are a vastly important item in the expensive construction of canals. We understand some of the weighlocks on the Erie canal cost the State $40,000. A large annual expense is also necessary to keep them in repair.

Again in the preservation of boats, it will be of great utility. We are told that they are injured more by weighing than in any other way. Some say our boats would last double the time they now do, if their weight should be ascertained without taking them into a weighlock.

Those who have seen Mr. Amsden try experiments of weighing, give it as their opinion that his invention will prove successful.

We think it would be well for our Canal Commissioners to examine its merits, before they go to the expense of constructing weighlocks for the enlarged canal.—*Rochester D. Adv.*

☞ The following lettter, charged with 18¾ cents postage, is only a common mode of subjecting publishers to expenses which are unjust, ungenerous, and extremely perplexing. We make it a rule to change the direction of the Journal always, and to supply missing numbers cheerfully, if we have them, when requested; but to be required to *pay postage* in addition, has very little tendency to promote that equanimity of temper so necessary in warm weather.—*Eds. R. R. J. & M. M.*

"*Editors American Railroad Journal:*—Please to direct the Journal to ——— at Port Jackson, Montgomery Co. N. Y., instead of this place."

Fultonville, N. Y. September 1st. 1838.

☞ The question is frequently asked—"Can a full set of the Railroad Journal, from January 1,1832,be obtained—and if so, at what price?" In reply, we say, that a few sets more can be furnished by *reprinting* three numbers of Vol. *four*, for 1835, which were destroyed by fire.

We can furnish *three* complete sets, of six volumes each, at this time, at $25 the set, half bound, and will send them, carefully packed, to order,

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New-York and Albany Railroad.—In correcting the addition of the income on this important avenue into the interior, from $850,000 to $990,000, the sum it should be, we inadvertently changed the revenue to be derived from the transportation of Cattle, from $40,000 to $400,000. We, however, repeat our former opinion—"that *any* estimate, upon the present data, will be more than realized when completed in 1842.

☞ For JARVIS please read JERVIS, at the close of the Water Commissioners' Report in our last number.

ENLARGEMENT OF THE ERIE CANAL.

NOTICE.—First. Sealed proposals will be received by the Canal Commissioners until 5 o'clock P. M on the 25th day of September next, for enlarging 2 1-2 miles of Canal Sections No. 1, 2, 3, 4, and 5, extending through the rock on Mountain Ridge, commencing near the head of the present Locks in the village of Lockport, together with all the Bridges, except Main Street Bridge, on the same.

Second. Proposals will also be received at the same time for enlarging Section No. 1, on the Genesee Level, commencing near the foot of the present locks, together with all the Bridges, Waste-Weirs and Culverts on the same.

Third. Proposals will also be received at the same time for constructing five sets of Double and combined Locks in the village of Lockport, together with the enlargement of the Race and the necessary Gates along the south side of the Locks, to pass the water from the upper to the lower level.

Fourth. Proposals will also be received at the same time for extending the length of the Tonawanda Dam, in the village of Tonawanda. Also, for repairing the present Dam, with the necessary abutments and protecting walls, and to construct an embankment, commencing at the village of Tonawanda, about 4 miles along the south side of Ellicot creek, together with the Docking on the same.

Fifth. Proposals will also be received at the same time for cutting a ditch from Mill Creek, near Tonewanda village, to a point a short distance above the Change Bridge in said village; together with the Bridges and Sluices on the same, and a wooden trunk Culvert under the Erie Canal, at the Niagara River.

The prices of work must include the expense of materials necessary for the completion of the same, according to the Plans and Specifications that will be presented at the time of receiving proposals.

The work in the first and second specifications, is to be completed by the first day of April, 1841.

That in the third specification, to be completed by the first day of March, 1843.

The work in the fourth and fifth specifications to be completed by the first day of October, 1839.

But the Culverts, Bridges and Wasteweirs, in the first and second specifications, to be completed by the first day of September, 1840.

The north tier of Locks in the third specification to be completed by the first day of March, 1841.

Security will be required for the performance of the contracts, and the propositions should be accompanied by the names of responsible persons, signifying their assent to become sureties. If the character and responsibility of those proposing, and the sureties they shall offer, are not known to the undersigned, or the Chief Engineer, a certificate of good character, and the extent of their responsibility, signed by the first Judge or Clerk of the county in which they severally reside, will be required.—The locations of the different works, and the plans of the several structures, with the specifications of the kind of materials and manner of construction, will be ready for examination by the tenth day of Septemqer next, at the Engineer's Office in the village of Lockport and at Thompson's Tavern in the village of Tonawanda; at which time and places, the Chief or Assistant Engineers will be in attendance, to explain plans, &c., and to furnish blank propositions. The undersigned will attend in the village of Lockport on the twenty-fourth day of September next.

The party to the propositions which may be accepted, will be required to enter into contracts immediately after the acceptance of the same.

The undersigned reserve to themselves the right to accept proposals for the whole, or any part of the above work.

Persons proposing for more work than they wish to contract for, must specify the quantity they desire to take.

The full names of all persons who are parties to any proposition, must be written out in the signatures for the same.

The prices, for the excavation and embankment, will be considered as including the expense of shaping and trimming the banks.

No transfer of Contracts will be recognised.

WM. C. BOUCK,
JONAS EARL, Jr.
JOHN BOWMAN,
WM. BAKER.
} Acting Canal Commissioners.

Lockport, 25th August, 1838. 5 2t

AVERY'S ROTARY ENGINE.

This Engine is now in use in various parts of the country, and is found to possess important advantages, as a driving power, for *Saw-Mills, Flouring Mills, Cotton Factories, Sugar Mills* and *Machine Shops*, over the ordinary Piston Engine.

Its advantage consists in economy in the *first cost*, and also in the cost of *fuel, repairs*, and *attendance*. Wherever one of them has been put in operation by a person acquainted with them, others have been ordered, and it will continue to be so wherever they may become known.

Orders for Engines, and Mill Machinery addressed to this office, or to Mr. Joseph Curtis, 71 Attorney street, will be promptly attended to. D. K. MINOR, Agent. tf

LONG ISLAND RAILROAD.

Will be issued from this Office in a few days, in pamphlet form, with Lithographed Illustrations; a full description of the Long Island Railroad, by an Engineer—which it is designed to make the commencement of a series of pamphlets—if Engineers can be induced to prepare them—giving full and complete descriptions of the different Railroads and Canals in the United States, which are, and as others may be hereafter completed. 5tf

PRESERVATION OF TIMBER.

THE PROPRIETORS of the invention of the late Robert Bill, of London, by which wood may be saturated throughout with a composition which has been found an efficient preservative against ordinary decay, the dry rot, and the gribble worm, having made such improvements thereon as have rendered the process more simple and efficient, are prepared to enter into contracts for the preparation of timber, and to dispose of the right of using the patent process.

The method in question is believed to afford complete protection to wood, even in the most exposed and disadvantageous positions, at a less cost than any other which has yet been proposed. It is applicable to every case in which timber is employed; and is particularly worthy of attention in the blocks with which streets are paved, the rails and sleepers of railroads, the frames and planking of the gates of canal locks, the timber used in building docks and wharves, when the ravages of the worm are to be feared, and the piles and the beams used in every species of hydraulic construction. The details of the process may be learned, and terms made known, on application to

JAMES TREAT,
General Agent of the Proprietors,
No. 4, Wall st. New York.

Certificates.

I have witnessed a number of the experimental operations, made for the purpose of testing the practicability of Robert Bill's process for the preservation of timber. In these it was shown, that by the addition of improvements to the original method, the perfect seasoning of timber, by the separation both of its sap and uncombined moisture, could be effected: that almost every description of wood on which experiment was made, was thoroughly saturated with the protecting material; and that in the single instance, (hemlock,) through whose pores the injection was not complete, enough was done to exclude all access of moisture. The proprietors have certificates of the exposure of wood, prepared by Bill's method to the most severe trials, for a space of five years; but were not this proof in their possession, it would be clear, from the high antiseptic properties of the material they employ, that wood, fully saturated with it, cannot be subject to any of the ordinary causes of decay. The power of the same material to repel the gribble worm is universally admitted, even when merely applied as a coating; but when injected throughout, it must act as a perfect protection.

Columbia College, N. Y. May 25, 1838.
JAMES RENWICK, LL.D.
Professor of Natural and Experimental Philosophy and Chemistry.

Certificate given by the British Government to Robert Bill.

"Timber prepared by Mr. Robert Bill was put into the dry rot pit in his Majesty's yard, Woolwich, where it remained for five years, and perfectly withstood the fungus rot, whilst numerous other specimens were destroyed in a fifth part of that time. Other pieces were placed in the sea, by the master shipwright at Sheerness; and while wood, considered impervious to the gribble worm, was nearly eaten up, these remained untouched. Some specimens of timber, so prepared were placed in the earth at his Majesty's yard, Deptford one half their length being buried, and the other half protruding above ground, and pieces cut from the same tree, but unprepared, were put in competition with them; at the end of five years the former remained unchanged, the latter entirely destroyed. These experiments prove that the inferior sorts of timber may be made, at a small expense, far more durable than oak, or perhaps any known wood, from which great national benefits may be derived.

JOHN KNOWLES,
Secretary of the Navy Board.

GENEVA, N. Y. 15th June, 1838.

Having seen several specimens of Wood saturated with Coal Tar (so called,) and believing its use would greatly tend to the preservation from decay of all exposed timber, in structures for Railroads, Bridges or Canals, I recommend its adoption, and believe said wood would prove to be one of the greatest elements of economy that has ever been introduced into works where timber forms a chief material.

J. G. SWIFT,
Late of the U. S. Army

LOCOMOTIVE ENGINES.

The subscribers have for sale in England, on account of whom it may concern:

Two very superior light locomotive engines with tenders, &c. complete. These engines are suitable for roads, the superstructure of which are of wood with flat bars. They are of BURY'S celebrated pattern, and would no doubt give great satisfaction:

ALSO—

Two 6 wheel engines of 11 tons weight, with fuel and water. These engines are of very superior workmanship. One of them could be delivered at New York, and the other in Philadelphia;

ALSO—

Two 4 wheel engines, warranted by the manufacturers not to weigh more than 7½ tons, with fuel and water. These engines are of a lot of 8 made at one establishment, of a particular pattern. Some of them are now running, and give very great satisfaction.

A. & G. RALSTON & CO.
South Front st. Philadelphia,

Who have on hand 800 tons of T rails, 2½ by 5-8, 2 by ½, 1¼ by ½, 1 1-4 by 1-4 and 1 by 1-4 flat bar rail road iron. Also Rims for Locomotives, cars, &c. &c. Orders for rail road iron executed as usual.

3 2m

NOTICE TO RAILROAD CONTRACTORS.

Western and Atlantic Railroad of the State of Georgia.

In addition to the 50 miles of this railroad farmed out for construction in April last, the grading and masonry on another equal portion of the same work, is now offered for contract.

SEALED PROPOSALS

Therefor, will accordingly be received at the office of the board of commissioners in Cassville, Cass county, Georgia, between the eighth and thirteenth of October next, during which time, engineers will be in attendance on the line of the road to point out the localities, and explain by the aid of plans and profiles of the route, the nature and extent of the work to be done.

This portion of the route traverses a limestone region, abounding in springs, and streams of fine water. The climate of the country is mild and salubrious. The frosts of winter are never so severe as to prevent easy and successful grading, even in the most inclement part of that season.

The time for the fulfilment of contracts will be amply sufficient for this purpose.—This and all other conditions relating thereto, will be exhibited in printed proposals and articles of agreement, blank copies of which will be in readiness for inspection, filling and signature, at the time and place above designated.

Credentials setting forth the character and competency of the contractors unknown to the commissioners will be required.

By order of the board of Commissioners.

S. H. LONG, Ch'f Eng'r.

Office of the W. & A. R. R.
Marietta, July 12, 1838. 4 4t

NEW ARRANGEMENT.

ROPES FOR INCLINED PLANES OF RAILROADS.

WE the subscribers have formed a co partnership under the style and firm of Folger & Coleman, for the manufacturing and selling of Ropes for inclined planes of railroads, and for other uses, offer to supply ropes for inclined planes, of any length required without splice, at short notice, the manufacturing of cordage, heretofore carried on by S. S. Durfee & Co., will be done by the new firm, the same superintendent and machinery are employed by the new firm that were employed by S. S. Durfee & Co. All orders will be properly attended to, and ropes will be shipped to any port in the United States.

12th month: 12th, 1836. Hudson, Columbia County, State of New-York.

ROBT. C. FOLGER.
GEORGE COLEMAN.

33—tf

THE NEWCASTLE MANUFACTURING COMPANY

Continue to furnish at the works situated in the town of Newcastle, Delaware, *Locomotive* & *other Steam Engines*—Jack Screws, Wrought iron work and Brass and Iron Castings, of all kinds connected with Steamboats, Railroads, & Mill Gearing of every description. Cast Wheels (chilled) of any pattern and size, with axles fitted also with wrought Tires; Springs, Boxes & Bolts for Cars; Driving and other Wheels for Locomotives.

The works being on an extensive Scale, all orders will be executed with promptness and dispatch. Communications addressed to Mr. William H. Dobb, Superintendent, will meet with immediate attention. ANDREW C. GRAY,

President of the Newcastle Manufact'g Co.
Newcastle, Del. March 6, 1838. 1y.

Literary and Scientific Course of Columbia College.

The students of this course will assemble in the College on Monday 1st October. Candidates for admission into the several classes will be examined on Friday, 28th September.

The object of this course is to afford to such persons as may not wish, or may not be prepared to enter upon the classical studies pursued in the college, full instruction in the mathematical, mixed, and physical sciences. For this purpose they are admitted to the instruction of the professors of those departments, and entitled to all the privileges of students in the regular classes. In addition, they have opportunities of pursuing the studies of English literature and history. The course has been planned with much care, as a preparation for the professions of the civil engineer, the architect, or the conducter of manufactures, and in order, more effectually to accomplish these objects, additional instructors are engaged, and arrangements made to teach the practice of engineering in the field, the use of instruments, the manipulations of practical chemistry, architectural, geometrical, and topographical drawing, &c. For these objects, great facilities are afforded in the increase of the apparatus, models and collections of the college.

A CARD.

A young man of unexceptionable character, having a desire to become practically acquainted with the business of a civil engineer, respectfully offers his services to any Railroad company as an assistant. He has some knowledge of mathematics, and is capable of repairing any mathematical instrument, having served an apprenticeship at said business, but is induced to this measure by a preference for more active life. Personal application at the office, or a line addressed to the editor of the Railroad Journal will meet with due attention.